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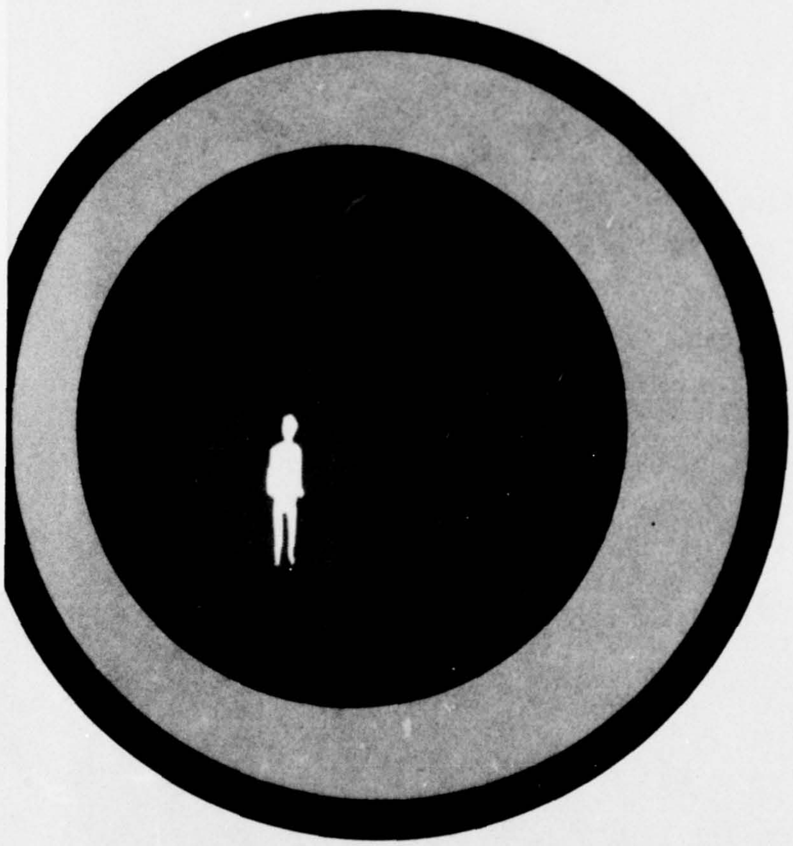
TAEG REPORT
NO. 50

AN AUTOMATED PUBLISHING SYSTEM FOR THE NAVAL EDUCATION AND TRAINING COMMAND



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NOVEMBER 1977

TRAINING ANALYSIS AND EVALUATION GROUP

ORLANDO, FLORIDA 32813

TAEG Report No. 50

AN AUTOMATED PUBLISHING SYSTEM FOR THE NAVAL EDUCATION AND TRAINING COMMAND

F. Laurence Keeler

Training Analysis and Evaluation Group

November 1977

Sponsored by

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Naval Technical Information Presentation Program

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This study analyzes the alternatives for meeting the publishing needs of the Naval Education and Training Command in the 1980s. The use of current, state-of-the-art equipment, including text editors, phototypesetters, and graphic scanners, is explored and five alternatives to the current publishing system are proposed. Based on an economic analysis, recommendations are made for an optimal publishing system for the 1980s.

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The support of a number of Training Analysis and Evaluation Group (TAEG) personnel is gratefully acknowledged. Dr. Richard Braby and Dr. Myron Zajkowski provided direction and guidance in the presentation of the material. Dr. William Swope assisted in the economic analysis and Miss Ann Caramico edited and prepared the report for publication.

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SECTION I

INTRODUCTION

The technological complexity of Navy systems has created a proliferation of technical manuals and training materials. The effort required to maintain the dynamic and growing volume of documentation using traditional methods has outstripped the available resources.

In response to the Naval Education and Training Command's increasing publishing requirements, this report presents models of publishing systems incorporating state-of-the-art techniques in authoring, editing, composing, typesetting, and illustrating as alternatives to the current traditional publishing system. These models are proposed to provide a range of options from which an optimal publishing system may be chosen to meet the needs of the Chief of Naval Education and Training (CNET). Model components and their functions are described and the cost effectiveness of each alternative analyzed. This information will provide guidance to the CNET in choosing a publishing system and will impact on the Naval Education and Training Program Development Center (NETPDC), the Personnel Qualification Standards Development Department (PQSDD), and the Instructional Program Development Centers (IPDCs). In addition, the information provides fundamental background data for the Navy Technical Information Presentation Program (NTIPP) being conducted by the David W. Taylor Naval Ship Research and Development Center.

BACKGROUND

The number of pages published by the Chief of Naval Education and Training Support (CNET SUPPORT) annually is staggering. In FY 76, an average of 9,000 copies each of over 1,200 different documents was published, each document averaging about 75 pages, for a total paper output of 750 million pages. These numbers, though impressive, would have doubled had the funding for printing been the $5 million requested rather than the $2.5 million actually budgeted. The increased emphasis now being placed upon onboard training and individualized instruction will increase the disparity between requirements and available funds since these techniques depend extensively on published materials. It is projected that the one new and four proposed IPDCs will increase the current publishing load by 66,000 original pages annually. Requirements for the first instructional materials to be authored by the IPDC in San Diego will be 3,000 copies annually. With a planned 3-year review and revision cycle an average of 9,000 copies will be made of each original page. Based on evidence that an average of 9,000 copies per document will be maintained, the total paper output for the IPDCs will exceed one-half billion pages. Thus, capacity for the production of two billion pages, nearly three times the FY 76 output, may be required in the near future.

The primary publisher in CNET SUPPORT is NETPDC. In addition to printing, the NETPDC is responsible for the authoring and updating of over 800 documents annually. The Rate Training Manuals (RTMs), Correspondence Courses (CCs), and Advancement in Rate Examinations (AREs) comprise the three major areas of the NETPDC effort and accounted for more than 35,000 camera-ready original pages in FY 76. Because a large portion of this publishing effort is devoted to the

revising and updating of existing training documents, text editing and composing are of major importance to the NETPDC. The NETPDC also is responsible for the printing of the CNET SUPPORT publications generated by the PQSDD and the IPDCs.

This report also is important to the NTIPP which is studying the problem of the total Navy technical manual needs. The assessment of the publishing needs of the training command, contained in section III of this report, is particularly important to the NTIPP effort. In addition, the publishing system alternatives proposed for meeting these needs serve as models for any system the NTIPP may recommend for meeting the Navy's needs in publishing technical manuals.

PURPOSE

The purpose of this report is to analyze the procedures and functions required for the publishing of Navy training materials and to describe the best suited and most cost-effective man/machine system to meet those requirements. To accomplish this purpose, the traditional CNET publishing system is described and then analyzed in terms of authoring, encoding, editing, illustrating, composing, typesetting, and printing. Based on this analysis, possible hardware elements for use in accomplishing these functions are described and five alternatives to the current publishing system are defined. An economic analysis forms the basis for recommendations for the implementation of an optimal system.

ORGANIZATION OF THE REPORT

In addition to this introduction, five other sections are presented. Section II contains a description of the current CNET publishing system. In section III, the CNET publishing requirements, in terms of both man and material resources, are delineated. Five progressively more sophisticated alternatives to the traditional and current publishing system are presented in section IV which is followed, in section V, by an economic analysis of these options. Finally, section VI makes recommendations for the implementation of an optimal publishing system. For the reader who is interested, three appendices have been included. Appendix A presents sample pages of CNET instructional materials in both the traditional format and the typeset format to demonstrate the substantial savings in paper and, consequently, printing costs which are available through the use of modern composition and phototypesetting equipment. An overview of the generalized publishing process is provided in appendix B for the reader unfamiliar with aspects of the publishing process. Appendix C contains a description of the hardware elements typically used in a publishing system.

SECTION II

THE CURRENT PUBLISHING SYSTEM

Most CNET publications come from two major sources: (1) the Personnel Qualification Standards Development Department and (2) the Naval Education and Training Program Development Center. These will soon be joined by a third source, the Instructional Program Development Center. Each of these groups is responsible for one or more distinct and qualitatively different sets of training documents (see appendix A for samples from typical training documents). The PQSDD writes the Personnel Qualification Standards (PQSs) which are sets of requirements for the operation and maintenance of specific watchstations. These assure that personnel, upon fulfillment of the requirements of a particular PQS, will be able to operate and maintain the equipment at the corresponding watchstation. The NETPDC writes the RTMs in part to support the theory portion of the PQSs, but primarily to communicate the knowledge required by the occupational standards as defined in the Manual of Navy Enlisted Manpower and Personnel Classifications and Occupational Standards (NAVPERS 18068D) published by the Bureau of Naval Personnel (BUPERS). The Correspondence Courses, also written by the NETPDC, aid personnel in acquiring this knowledge. Thus, both occupational standards and the RTMs impinge upon these courses. The NETPDC also writes the AREs which discriminate among the examinees those who have best acquired the knowledge, defined by the occupational standards and communicated by the RTMs and CCs. Finally, the IPDCs are preparing instructional programs to replace the courseware previously generated by the schools.

There is also a large amount of courseware which continues to be generated by the schools, which, because of the diverseness of this effort, will not be dealt with in this study. However, the computer-aided system to be proposed may be able to encompass some composing and typesetting in support of this effort.

PERSONNEL QUALIFICATION STANDARDS DEVELOPMENT DEPARTMENT

A PQS is a written compilation of the knowledge and skills required of an individual to qualify for a specific watchstation, maintain a specific equipment or system, or perform as a team member within an assigned unit. It is derived from a task analysis and is written in the format of a qualification guide, asking the questions a trainee must answer to verify his readiness to perform the given task. Each PQS has an eight page introduction, which is identical for all PQSs, a table of contents, and approximately 140 pages of standards divided into four sections.

- The Theory section specifies the background theory required as a prerequisite for studying the specific equipment.

- The Systems section breaks the equipment into its functional sections and requires an explanation as to the location, operation, and function of each.

- The Watchstation section delineates the procedures required for the operation and maintenance of the equipment.

The Qualification Card section serves for recording satisfactory completion of the designated sections of the standards by demonstration of the prescribed skill or knowledge.

Each of the four sections is rigidly structured. (See appendix A - Samples from Personnel Qualification Standards, Rate Training Manuals, and Instructional Program Development Materials.)

The PQSDD is responsible for writing the PQSs and is manned by subject matter specialists, editorial assistants, typists, and the necessary administrative personnel. The key personnel, the subject matter specialists, are frequently Chief Petty Officers who have been selected from active sea duty and assigned temporary additional duty (TAD) at the PQSDD. They are chosen on the basis of their expertise on a particular equipment in the operational environment.

The sequential steps involved in publishing a PQS together with the personnel involved are listed in table 1. It also depicts graphically the number of times and the order in which the individuals or organizations take part in the publishing process. It should be noted that there is no mention of composition in the process. This function is accomplished by the typists within the framework imposed by the rigid structure. An unusual feature is that the author never sees the product during or after the review and editing cycle. This is because the subject matter specialist is only temporarily assigned to the authoring task and has returned to a permanent duty station before the review can be completed.

NAVAL EDUCATION AND TRAINING PROGRAM DEVELOPMENT CENTER

The NETPDC is located at Pensacola and is responsible for the authoring and publishing of the RTMs, Nonresident Career Courses, Enlisted and Officer CCs, and AREs. In FY 76 NETPDC published over 1,200 other training documents but the RTMs, CCs, and the AREs constitute its major products.

The NETPDC is comprised of one production branch, responsible for composition and illustration, and nine writing branches. Each writing branch is responsible for the researching, reviewing, and updating of the RTMs, CCs, and AREs for the occupational classes assigned to it. The branches also research and author single subject manuals, training modules, and other special purpose training materials. Each Branch Head has a pool of subject matter specialists, editors, and typists, so that the branch may act as an autonomous group in authoring the training materials assigned to it.

RATE TRAINING MANUALS. Rate Training Manuals are designed to provide knowledge about the subject matter relating to the occupational qualifications of the particular rating. Because they are texts, and are specific only to a given level of rate and rating, the RTMs are much less structured than the PQSs. They generally contain a chapter on the requirements for advancement in the appropriate rating followed by a chapter on the department to which the rated person is usually assigned. A chapter or two on the background principles and fundamentals required for further study in the text may also be included, but beyond this, the RTM's structure is relatively general. OPNAV Instruction

TABLE 1. STEPS AND PERSONNEL INVOLVED IN THE PUBLISHING OF A PERSONNEL QUALIFICATION STANDARD (PQS)

SEQUENCE OF STEPS	TYPIST	SBJ. SPEC.	EDITORIAL ASST.	SUPERVISOR	DIRECTOR	CNET	COMMANDS	PUB. & PRINTING BRANCH	NPPSO	PRINTER	NAVPUBFORMCEN
1. Perform task analysis and prepare handwritten draft.		●									
2. Check grammar and format of draft.			●								
3. Type draft onto mag-cards.	●										
4. Check spelling and verify all changes incorporated.			●								
5. Check editorial changes to assure that technical meaning has been retained and make necessary changes.				●							
6. Retype document as a "preliminary draft" from the mag-cards.	●										
7. Review preliminary draft and recommend changes.							●				
8. Incorporate recommended changes into preliminary draft.				●							
9. Check grammar and format of changes.			●								
10. Retype document as "smooth copy" from mag-cards.	●										
11. Check and approve smooth copy.				●							
12. Approve and forward a copy of final publication to CNET for approval.					●						
13. Approve and notify Director of final approval.						●					
14. Send camera-ready copy to NETPDC Publication and Printing Branch.					●						
15. Review copy for proper format; determine kind of paper, size, binding, number of copies, specifications for printing, and distribution; forward printing package to NPPSO.								●			
16. Send printing package to Government Printing Office, Atlanta, who in turn sends them to a printer.									●		
17. Prepare negatives and plates, print PQS, make initial distribution and forward remainder to NAVPUBFORMCEN.										●	
18. Warehouse and maintain stock level limits. Fill orders from requisitioners.											●

3500.84B has directed that the RTMs include information "which will enhance their use as study references in meeting the requirements of PQS." However, RTMs are written at an occupational level, such as that of "Fireman," rather than that of a specific duty level, such as "Security Watch," as is covered by a PQS. Table 2 lists the sequential steps required in publishing RTMs together with the personnel involved and a description of the functions accomplished. It also graphically depicts the number of times and the order in which the individuals or organizations take part in the publishing process.

CORRESPONDENCE COURSES. While RTMs comprise the major portion of the output of the NETPDC, that activity is also responsible for the Nonresident Career Courses and Enlisted and Officer CCs. These CCs are designed to aid a student in acquiring the knowledge and skills required by the occupational standards and communicated by the RTMs. Thus, their revision cycle is linked to that of the RTMs. The CCs are accompanied by answer forms designed to give the student immediate knowledge of results. These forms, called Self Scoring Answer Sheets (SSASs), require the subject to erase an opaque material covering the box corresponding to the answer he has selected. A "C" is revealed if the answer is correct. An optical scanner is used to record the number of correct and incorrect responses when the subject returns his form for grading. Assignments in the CCs are constructed to have up to 75 questions each, corresponding to the 75 response spaces provided on the form. The number of assignments in a course averages about the same as the number of chapters in the corresponding RTMs. Table 3 lists the sequence of steps together with the performers of these steps required in publishing the CCs.

ADVANCEMENT IN RATE EXAMINATIONS. Advancement in Rate Examinations are written to discriminate among those qualified for advancement. New E-3 examinations are required only as dictated by changes in the occupational standards. However, the requirement for competitive examinations for further advancement necessitates the publishing of new E-4 through E-6 examinations every 6 months, and new E-7 through E-9 examinations annually. Thus there is a continual examination publishing requirement, and 788 examinations are published annually. Table 4 depicts the sequence of steps required for the publishing of the AREs.

INSTRUCTIONAL PROGRAM DEVELOPMENT CENTERS

The first of five planned IPDCs has been established in San Diego. Four additional sites are scheduled to become operational during the next 5 years and will be located at Great Lakes, Memphis, Norfolk, and Pensacola. Each of these sites is scheduled to publish 12,000 pages of new training modules annually, with an additional capability of 10 percent for revisions. Very few Instructional Program Development Materials (IPDMs) have been published by the IPDC in San Diego, as yet; therefore, a diagram of the steps involved, as was provided for other CNET publications, cannot be made. However, the concepts of Instructional Systems Development underlying the establishment of the IPDCs dictate a highly proceduralized and structured format together with the liberal use of illustrations.

TABLE 2. STEPS AND PERSONNEL INVOLVED IN THE PUBLISHING OF A RATE TRAINING MANUAL

SEQUENCE OF STEPS	TYPIST	AUTHOR	ED. SPEC.	EDITOR	DIVISION OFFICER	DIVISION HEAD	COMMANDS	ILLUSTRATOR	COMPOSITOR	PRODUCTION HEAD	PUBS. & PRNTG BRANCH	NPPSO	PRINTER	NAVPUBFORCEN
The first five steps are performed on a per manual basis.														
I. Prepare letter soliciting review of current RTM by cognizant commands.		●												
II. Review current RTM and send remarks to NETPDC.							●							
III. Compile recommendations made by commands and others collected in "bilge copy." Review current occupational standards and PQSs to assure proper coverage. Decide which chapters require changes and prepare a plan of action.		●												
IV. Review the Plan of Action.						●								
V. Plan scheduling of revisions, chapter by chapter.		●				●				●				
The next 24 steps are performed on a chapter by chapter basis.														
1. Make pencil draft of new or revised chapter.		●												
2. Type rough draft of chapter manuscript.	●													
3. Review and revise draft manuscript of chapter.		●												
4. Review draft for proper training formats and assure that occupational standards are properly included.			●											
5. Incorporate changes required by Ed. Spec's review.		●												
6. Review and edit to unify literary style and arrangement of tabular material.				●										
7. Check editorial changes to verify that the meaning has not been changed.		●												
8. Type "smooth" copy of chapter manuscript and cover letter for sending it to commands.	●													
9. Approve chapter manuscript and send to commands.						●								

TABLE 2. STEPS AND PERSONNEL INVOLVED IN THE PUBLISHING OF A RATE TRAINING MANUAL (continued)

SEQUENCE OF STEPS	TYPIST	AUTHOR	ED. SPEC.	EDITOR	DIVISION OFFICER	DIVISION HEAD	COMMANDS	ILLUSTRATOR	COMPOSITOR	PRODUCTION HEAD	PUBS. & PRNTING. BRNCH	NPPSO	PRINTER	NAVPUBFORMCEN
10. Review chapter manuscript and recommend additions or corrections.							●							
11. Incorporate Command's recommendations in chapter.		●												
12. Make changes to chapter manuscript.	●													
13. Review spelling, grammar and format of additions.				●										
14. Recheck editorial changes to assure intended meaning has been preserved.		●												
15. Make final check to assure training principles met.			●											
16. Review chapter manuscript.					●									
17. Review and approve chapter manuscript.						●								
18. Retype chapter manuscript on mag-tape in galley format.									●					
19. Collect required illustrations for chapter and redraw or retouch those for which photo-ready quality copies are not available.								●						
20. Make layout of where text and illustrations will appear on each page. Run text from galley-formatted mag-tape into composed pages of text, leaving proper spacing for illustrations as dictated by the layout.									●					
21. Approve composition and illustrations for chapter.										●				
22. Proof composed masters for typographical errors.									●					
23. Proof composed masters for typographical or any other error.		●												
24. Make required corrections to camera-ready copy.									●					

TABLE 2. STEPS AND PERSONNEL INVOLVED IN THE PUBLISHING OF A RATE TRAINING MANUAL (continued)

SEQUENCE OF STEPS	TYPIST	AUTHOR	ED. SPEC.	EDITOR	DIVISION OFFICER	DIVISION HEAD	COMMANDS	ILLUSTRATOR	COMPOSITOR	PRODUCTION HEAD	PUBS. AND PRINTING BRANCH	NPPSO	PRINTER	NAVPUBFORMCEN
The remaining six steps are performed on a per manual basis, after the chapters have been completed.														
VI. Prepare index and table of contents.									●					
VII. Prepare job information sheet.										●				
VIII. Review copy for proper format. Determine number of copies, kind of paper, size, binding, and specifications for printing. Estimate printing costs and forward printing package to NPPSO.											●			
IX. Send publication to GPO in Atlanta which sends it to printer.												●		
X. Prepare negatives and plates, print required number of copies.													●	
XI. Make initial distribution of new and revised RTMs. Warehouse and maintain stock level limits.														●

TABLE 3. STEPS AND PERSONNEL INVOLVED IN THE PUBLISHING OF A CORRESPONDENCE COURSE

	SEQUENCE OF STEPS	TYPIST	SBJ. SPEC.	ED. SPEC.	EDITOR	DIVISION HEAD	ILLUSTRATOR	PUB. & PRNTING BRNCH	NPPSO	PRINTER
	The first seven steps are performed in units on an RTM chapter by chapter basis.									
A.	Decide how much of existing course material may be reused.		●	●						
B.	Assemble existing items and write new items as required.		●							
C.	Type new items, one to a page.	●								
D.	Review items for technical content.		●							
E.	Review items for form and educational effectiveness, and check chapter page references and answer indicators.			●						
F.	Select and order required graphic materials.		●							
G.	Collect illustrations and redraw those for which camera-ready copies do not exist.						●			
	The next nine steps are performed on a course assignment by assignment basis.									
1.	Assemble course units into assignments of 75 items each.	●								
2.	Edit assignments for uniformity of literary style.				●					
3.	Review editorial changes for technical meaning.		●							
4.	Prepare cross reference to text from composed text proofs.			●						
5.	Type camera-ready copy of assignment, proofread it, and type answer-key.	●								
6.	Make final editorial review.				●					
7.	Paste-up illustrations.		●							

TABLE 3. STEPS AND PERSONNEL INVOLVED IN THE PUBLISHING OF A CORRESPONDENCE COURSE **(continued)**

	SEQUENCE OF STEPS	TYPIST	SBJ. SPEC.	ED. SPEC.	EDITOR	DIVISION HEAD	ILLUSTRATOR	PUB. & PRNTING BRNCH	NPPSO	PRINTER
8.	Prepare scoring section.			●						
9.	Type scoring section and self scoring answer sheet.	●								
	The next nine steps are performed on a correspondence course by course basis.									
I.	Prepare front matter, including the retirement point credit.			●						
II.	Prepare back matter.	●								
III.	Edit front and back matter				●					
IV.	Type front and back matter, number course pages and verify camera-ready copy against original.	●								
V.	Make final Ed. Spec's review.			●						
VI.	Make final review and approve.					●				
VII.	Make final corrections.	●								
VIII.	Prepare Logistics Requisition.			●						
IX.	Verify self scoring answer sheets. Prepare cover, heads, special marks and course release letter.	●								
	The following steps are performed if the correspondence course is not to be bound with an RTM.									
X.	Review camera-ready copy for proper format. Determine number of copies, kind of paper, size, binding, and specifications for printing. Estimate printing costs and forward printing package to NPPSO.							●		
XI.	Send package to GPO in Atlanta which in turn sends it to printer.								●	
XII.	Prepare negatives and plates; print required number of copies and forward to Publications and Printing Branch.									●
XIII.	Fill orders for copies. Warehouse correspondence courses and maintain stock level limits.							●		

TABLE 4. STEPS AND PERSONNEL INVOLVED IN THE PUBLISHING OF AN ADVANCEMENT IN RATE EXAM

SEQUENCE OF STEPS	TYPIST	EXAM WRITER	SBJ. SPEC.	ED. SPEC.	DIVISION OFFICER	DIVISION HEAD
1. Revise scope of ratings/rates with respect to occupational standards. Prepare Test Plan and Outline.		●				
2. Meet to review and approve Test Plan and Outline.		●	●	●	●	
3. Inventory test item bank and prepare test item inventory sheet. Select usable items from test item bank and tally EDD-3 difficulty levels. Prepare rough draft using control items only, calculate difficulty level and adjust P value as necessary. Draft new test items as required by occupational standards.		●				
4. Review new test items.				●		
5. Type new and revised test items.	●					
6. Prepare rough book: cutting and pasting items, illustrations, standard blurbs and bibliography. Check coding references, occupational standards and response balance. Prepare rough routing sheet.		●				
7. Review and coordinate rough book.				●		
8. Make layout and type rough book onto smooth dummy mats. Check for errors and correct mats.	●					
9. Check smooth draft including illustrations.		●				
10. Review smooth draft including illustrations.					●	
11. Review smooth draft.				●		
12. Make corrections and alterations to smooth book. Type information sheet from rough routing sheet. Make final corrections.	●					
13. Review examination book.				●		
14. Review examination book and release for printing.						●
15. Perform vault verification. Prepare and verify answer keys. Verify and audit machine run listing.		●				

SECTION III

THE CURRENT AND PROJECTED PUBLISHING SYSTEM REQUIREMENTS

This section analyzes the requirements of the CNET publishing system, both current and projected, in terms of the throughput for each of the basic publishing functions. This analysis addresses not only the overall requirements of the CNET publishing system but also the requirements of each subsection and it is included here so that a system capable of meeting the diverse publishing needs with a minimum of logistic and other problems may be proposed. The basic publishing functions will be addressed individually and the throughput and manpower requirements of each defined for each major type of publication. The results of this analysis are summarized in tables 5 and 6.

In comparing various publishing requirements, it is necessary to have a common unit of measure. The page is a familiar unit of measure, but, unfortunately, is not a very good one for studying the publishing functions. A typed manuscript page, for instance, may only account for one-third of a composed and phototypeset page of text. Thus, the less familiar, but more constant measure, the character, will be used as the unit of measure in defining all publishing functional requirements, with the exception of illustrating, platemaking, and printing. The illustration, the plate, and the impression will be retained as the measure for each of these, respectively. The following conversion factors are used in translating pages to characters: one double spaced manuscript page with 1-inch margins (25 6-inch lines) is equivalent to 1,500 characters; one page of text, composed in two-column format (100 3½-inch lines) is equivalent to 4,500 characters.

PERSONNEL QUALIFICATION STANDARDS

AUTHORING. The Personnel Qualification Standards Development Department produces about 66 new and revised PQSs annually. The average PQS consists of a basic qualification standard of about 143 pages and two or three qualification "cards" (actually, pocket-sized booklets) of about 22 pages each, for a total of about 195 pages. Virtually, the entire PQS is heavily structured tabular material containing approximately 2,000 characters per page or 400,000 characters per PQS. The initial authoring effort, prior to the editing and review phase requires, on the average, 3,080 man-hours per PQS. Before the document is released for encoding it will be submitted for review by the work station supervisor (98 man-hours) and the editorial assistant (60 man-hours) to bring the authoring total to 3,138 man-hours per PQS. Thus, the annual authoring effort generates 26,400,000 characters (12,870 pages) and requires 210,408 man-hours (105.4 man-years).

ENCODING. Although it was intended for PQS items to be reused to reduce the encoding load, in practice, each PQS is essentially rewritten and no items are reused without modification. Thus, for every new or revised PQS, the initial handwritten author's output of 400,000 characters of heavily formatted material is keyboarded _in toto_. This encoding is done using IBM Mag-Card II Word Processors and is recorded on mag-cards, before being output as the "draft

TABLE 5. CURRENT PUBLISHING FUNCTION REQUIREMENTS

PUBLICATION TYPE		PQS	RTM	CC	ARE	IPDM	TOTAL
PUBLISHING SITE		SDO	PNS	PNS	PNS	SDO*	
FUNCTION	UNITS						
AUTHORING	(million characters)	26.4	45.0	1.3	39.4	25.2 (50.4)	137.3 (162.5)
ENCODING	(" ")	26.4	45.0	1.6	39.4	25.2 (50.4)	137.6 (162.8)
EDITING	(" ")	6.6	4.5	1.3	2.2	2.5 (5.0)	17.1 (19.6)
COMPOSING	(" ")	26.4	48.0	13.0	39.4	25.2 (50.4)	152.0 (177.2)
TYPESETTING**	(" ")	26.4	48.0	13.0	39.4	25.2 (50.4)	152.0 (177.2)
ILLUSTRATING	(thousand illust.)	0	4.8	.7	3.9	4.0 (8.0)	13.4 (17.4)
PLATEMAKING	(" plates)	12.9	29.2	14.7	19.4	12.0 (24.0)	88.2 (100.2)
NEGATIVES	(" negs.)	12.9	11.0	5.4	19.4	12.0 (24.0)	60.7 (72.7)
HALFTONES	(" negs.)	0	3.8	0	0	3.0 (6.0)	6.8 (9.8)
"CUT-INS"	(" cut-ins)	0	4.8	0	0	4.0 (8.0)	8.8 (12.8)
PRINTING:							
PUBLICATIONS		66	80	153	788	101 (20)	1097 (1107)
BINDINGS	(thousand bindings)	369.6	568.7	464.8	600	900 (1800)	2903.1 (3803.1)
IMPRESSIONS	(million impressions)	156.3	207.6	27.7	472.8	108 (216)	972.4 (1080.4)

* The first of five IPDCs is operational in San Diego. The figures in parentheses reflect the anticipated requirements when the second IPDC becomes operational in Great Lakes.

**Typesetting is not currently performed as a separate operation from composing, but would be under alternative publishing systems.

TABLE 6. CURRENT MANPOWER REQUIREMENTS FOR THE PUBLISHING FUNCTIONS

PUBLICATION TYPE		PQS	RTM	CC	ARE	IPDM	TOTAL
PUBLISHING SITE		SDO	PNS	PNS	PNS	SDO*	
FUNCTION	UNITS						
AUTHORING	(man-years)	105.4	75.3	19.4	56.0	25.3 (50.6)	281.4 (306.7)
ENCODING	(" ")	2.6	6.6	1.0	6.3	2.2 (4.4)	18.7 (20.9)
REVIEWING	(" ")	5.3	5.4	7.5	9.0	2.3 (4.6)	29.5 (31.8)
EDITING	(" ")	3.6	2.4	2.5	1.2	0.9 (1.8)	10.6 (11.5)
COMPOSING	(" ")	--	4.9	--	--	-- (--)	4.9 (4.9)
ILLUSTRATING	(" ")	--	13.2	2.0	1.5	11.0 (22.0)	27.7 (38.7)

* The first of five IPDCs is operational in San Diego. The figures in parentheses reflect the anticipated requirements when the second IPDC becomes operational at Great Lakes.

copy." Each PQS requires 80 man-hours to encode; thus, the annual encoding effort required for the 66 PQSs is 5,280 man-hours (2.6 man-years) to output 26,400,000 characters.

EDITING. After an editorial check which requires 24 man-hours by the editorial assistant, the "draft copy" mag-cards are edited and output as the "preliminary draft." This editing procedure results in approximately a 10 percent or a 40,000 to 80,000 character change to the "draft copy" and involves an average of 60 typist-hours of effort per PQS.

The "preliminary draft" is submitted to the cognizant commands for review by their subject specialists. Following this review, the work station supervisor and editorial assistant expend 136 man-hours per PQS incorporating the changes recommended by the commands and a typist edits the "preliminary draft" into the "smooth copy." This final editing step involves an average 5 percent or 20,000 character change to the "preliminary draft" and requires another 40 man-hours of a typist's time. After final approval has been obtained, the heavily structured text is run onto masters from the mag-cards, the page numbers are added, and the masters are sent as photo-ready copy for printing. An average of 8 typist-hours per PQS or an annual effort of 528 typist-hours (.3 man-years) is required for accomplishment.

Thus, each PQS requires 15 percent or 60,000 characters of editorial changes involving 100 man-hours of keyboard operators' time, and 160 man-hours of professional staff effort. Annually, for 66 PQSs, this amounts to 6,600,000 characters to be changed and requires 10,560 man-hours (5.3 man-years) of professional staff effort and 6,600 typist-hours (3.6 man-years).

COMPOSING. No formal composition, beyond the adding of page numbers to the manuscript pages accomplished in the final stage of editing, is performed on the PQS. This could be a costly omission, however, because preliminary estimates indicate that up to 50 percent of the total volume of pages could be saved through the use of proportional letter spacing and other sophisticated composition techniques.

TYPESETTING. The typesetting of the PQS is currently accomplished as the final output of the "smooth copy" from the IBM Mag-Card II Word Processors. If a requirement to perform this function as a separate effort existed it would require that 400,000 characters per PQS or 26,400,000 characters annually be set.

ILLUSTRATING. The PQSs have no illustrations.

PLATEMAKING. No special techniques are required in the making of plates. As previously noted, the number of plates could be reduced through the use of more refined composition. The current requirement averages 195 plates per PQS or 12,870 plates for the 66 PQS published annually.

PRINTING. The average number of copies for each of the new and revised PQSs in FY 76 was 5,600. This results in a printing load of 1,092,000 impressions per PQS or 72,072,000 impressions annually at a cost of $245,945 for the 66 PQSs. In addition there is a heavy reprint load associated with PQSs.

Approximately 60 PQSs were reprinted in FY 76 averaging 7,200 copies each, for a reprint load of 84,240,000 impressions at a cost of $248,000. Thus, the total FY 76 printing load for PQSs was 156,312,000 impressions at a cost of $493,945. These figures reflect the printing load for a particularly austere year. If the PQS program is to continue to be supported by the present publishing system, more funds will have to be allocated for printing.

RATE TRAINING MANUALS

AUTHORING. The RTMs are authored in the nine writing branches of the NETPDC at Pensacola. The NETPDC annually publishes about 30 new or revised RTMs. The average RTM contains 20 chapters, with approximately 75,000 characters per chapter. The typical RTM contains about 1,600,000 characters, including table of contents, appendices, and indexes.

The preparation for authoring a new or revised RTM requires an average of 535 man-hours for researching, planning, and administration. Once the outline plan for writing or revising an RTM has been approved, 224 man-hours of authoring effort will be expended per chapter before each is ready for encoding. This amounts to an authoring load of 1,500,000 characters requiring 5,015 man-hours per RTM, or an annual load of 45,000,000 characters requiring 150,450 man-hours (75.3 man-years) of effort.

In addition to the 30 new or revised RTMs published each year, 50 are "reprinted with minor revisions." When the minimum stock level of an RTM is reached, a check is made with the NETPDC to assure that a new revision is not about to be released. If no major revision is scheduled, changes may be incorporated in a "reprint with minor revisions." The authoring load on these is very light, probably averaging less than 1 hour per reprint, and is a negligible part of the total authoring man-hour load.

ENCODING. The 75,000 characters per chapter are keyboarded using conventional office machines. This operation requires 22 typist-hours per chapter including 4 hours for proofreading. Totals for this function are 1,500,000 characters and 440 man-hours per RTM, or an annual encoding load of 45,000,000 characters and 13,200 man-hours (6.6 man-years).

EDITING. Once the chapter has been encoded, 18 man-hours will be expended in review and editing by professional staff in-house. In addition 5 typist-hours will be expended in soliciting review and comments from outside sources. The in-house and outside reviews result in an average of 10 percent changes requiring 3 additional man-hours of typist effort. This equates to 150,000 characters of editing per RTM at a cost of 360 man-hours of professional staff effort and 160 typist-hours, or an annual editing load of 4,500,000 characters requiring 10,800 professional staff man-hours (5.4 man-years) and 8,800 typist-hours (2.4 man-years).

COMPOSING. The RTMs are composed by the Production Branch of the NETPDC using IBM Magnetic Tape Selectric Composers (MTSCs). The encoding of the 75,000 characters per chapter in galley format on mag-tape requires 8 man-hours. Another 6 man-hours are required for layout of the text and illustrations and to run the text from the galley formatted mag-tape into composed pages. The composers also prepare the table of contents and the index which requires an additional 40 man-hours per RTM. Thus, the total composition load is 1,600,000 characters and 320 man-hours per RTM, for a total of 48,000,000 characters and 9,600 man-hours (4.8 man-years) annually for the new and revised RTMs.

The Production Branch also makes the changes required for the "reprint with minor revisions" RTMs. These changes are made to the printing negatives and require, on the average, 4 man-hours per RTM to accomplish. Thus, the 50 RTMs "reprinted with minor revisions" add 200 man-hours to the annual composition load, bringing the total to 9,800 man-hours or 4.9 man-years.

ILLUSTRATING. The average RTM has 160 illustrations, or an average of 8 illustrations per chapter. However, because most illustrations are reused in several different manuals and may be used from revision to revision, an average of only 40 man-hours is required for the new illustrations required for each chapter. The collecting and retouching of the remaining illustrations averages 4 man-hours per chapter. Thus, the illustrating load per RTM is 160 illustrations and 880 man-hours. This equates to an annual illustrating load of 4,800 illustrations and 26,400 man-hours (13.2 man-years).

TYPESETTING. The typesetting of the RTMs is currently accomplished by the Production Branch of NETPDC on the photo-ready masters as the final output from the MTSCs. If a requirement to perform this function as a separate effort existed, it would require the setting of 1,600,000 characters per RTM or 48,000,000 characters annually.

PLATEMAKING. There are an average of 365 pages, 160 with illustrations, per RTM. Approximately 80 percent, or 128, of the illustrations are photographs which require screening for halftones, and virtually all of the remainder require photo-reduction. Thus, the platemaking load per RTM requires 365 "text" negatives, 128 screened negatives, and the "cutting in" of the 160 illustration negatives, as well as 365 plates which are the output. This amounts to an annual platemaking load of 10,950 "text" negatives, 3,840 screened negatives, 960 photo-reduced negatives, the cutting in of 4,800 illustration negatives, and 10,950 printing plates.

The platemaking load created by the 50 "reprint with minor revisions" RTMs requires making new negatives for only the affected pages, since the other negatives may be reused. However, it does require the making of all new plates because old plates are not saved. This amounts to 365 plates per reprint or 18,250 plates annually. This increases the total platemaking load to 29,200 plates annually.

PRINTING. The average printing for the 30 new and revised RTMs was 10,390 copies each for a total of 311,700 copies in FY 76. With an average of 365 pages per RTM, the printing load was 113,770,500 impressions at a cost of $384,900. The 50 "reprint with minor revisions" RTMs averaged 5,140 copies each for a total of 257,000 copies. At 365 pages per copy, an additional 93,805,000 impressions at a cost of $191,175 was added, creating a total printing load of 207,575,500 impressions for RTMs at a total cost of $576,075.

CORRESPONDENCE COURSES

AUTHORING. The CCs are authored in the NETPDC at Pensacola by the writing branch responsible for the related RTM or Officer Text. The NETPDC produced 54 new or revised CCs in FY 76; 42 for enlisted personnel (NRCC and ECC) and 12 for officers (OCC) or officers and enlisted personnel (OCC/ECC). The enlisted courses average 12 assignments per course, and the officer courses average 16 assignments per course, thus averaging about 13 assignments per course, overall. Each assignment may contain up to 75 questions, with the average being 67. Most of the items are taken from earlier revisions of the same or similar courses with an average of only about 10 percent of the items being new. Each item averages about 275 characters.

Prior to the editing phase, the initial authoring effort for each assignment requires, on the average, the review of 18,500 characters and the writing of 1,850 characters at an expenditure of 47 man-hours. An additional 8.25 man-hours is expended in arranging the questions into assignments, preparing a cross reference to the text and ordering required illustrations, and preparing the SSAS and answer key. Thus a total of 55.25 man-hours are expended in authoring each assignment. This translates into an average of 240,500 characters to be reviewed and 24,050 characters to be written at a cost of 720 man-hours for each course. This equates to an annual authoring load of 12,987,000 characters to be reviewed and 129,870 characters to be newly written at a cost of 38,880 man-hours (19.4 man-years).

ENCODING. Because 90 percent of the previous questions are reused, excluding the SSASs, only 10 percent require encoding. This amounts to 24,050 characters encoded at an expenditure of 13 typist-hours per course or an annual total of 1,298,700 characters encoded at an expenditure of 702 man-hours. Although the encoding of the SSASs involves only about 500 characters, the adherence to the rigid format required for machine scoring necessitates the expenditure of two typist-hours per assignment so that 26 man-hours per course is required. This equates to 331,000 characters annually at a cost of 1,404 man-hours. Thus, the total encoding load for the CCs is 2,000,700 characters at an expenditure of 2,106 man-hours (1 man-year) of effort.

EDITING. Review and editing of the questions after the new items have been encoded requires 6 subject-matter-expert hours, 12 education-specialist hours, and 4 editor-hours or a total of 22 man-hours per assignment. No typing or typist-hours are required for the estimated 10 percent editorial changes because they are incorporated as a part of the composing function. This amounts to an editing load of 24,050 characters changed at an expenditure of 286 man-hours per course or an annual editing load of 1,298,700 characters changed at an expenditure of 15,444 man-hours (7.5 man-years).

COMPOSING. The CCs are composed in the writing branches of the NETPDC by typing the camera-ready copy on 9 X 12 inch masters. The typists also incorporate the editorial changes at this time. The 18,500 characters per assignment require an average of 7 typist-hours to compose. Thus, an average of 91 man-hours is required to compose the 240,500 characters of a course, or an annual effort of 4,914 man-hours (2.5 man-years) for the 12,987,000 characters in the 54 CCs composed annually.

ILLUSTRATING. The CCs are not illustrated heavily and average only about one illustration per assignment. An illustration requires an average of .25 man-hours for the subject matter expert to order and 5.5 man-hours for the illustrator to create. Courses, therefore, require an average of 13 illustrations and an expenditure of 75 man-hours per course, or an annual effort of 4,050 man-hours for the 702 illustrations required.

TYPESETTING. The typesetting of the CCs is currently accomplished by the typists in the writing branches of the NETPDC on the camera-ready masters as a part of the composing function. If typesetting were to be accomplished as a separate effort it would require the setting of an average of 240,500 characters per course or a total of 12,987,000 characters for the CCs annually.

PLATEMAKING. The few illustrations that the CCs have are line art which is pasted-up by the writing branches and does not require screening. Therefore, no special illustration negatives are required. The 59 new and revised enlisted courses averaged 85 pages each, thus requiring a total of 4,560 negatives and plates in FY 76. There were 71 new and revised SSASs printed in FY 76, averaging 13 sheets each for a platemaking load of 923 negatives and plates.

There were 99 reprints of CCs printed in FY 76, giving rise to a platemaking load of 8,415 plates. Also, in FY 76, 73 SSAS sets were reprinted, yielding an additional platemaking load of 949 plates. Since the negatives are saved, none are required to be made for reprints.

The total platemaking load in FY 76 for reprints as well as new and revised CCs and SSASs was 5,483 negatives and 14,847 printing plates.

PRINTING. The average number of copies for each of the new and revised CCs was 2,806 for FY 76. The 54 new and revised courses, with an average of 85 pages each, thus accounted for 151,500 copies and a total of 12,877,500 impressions at a cost of $47,300.

The 99 reprints of the CCs averaged 1,579 copies per publication, or a total of 156,290 copies and 13,284,650 impressions. The cost of reprinting the 99 enlisted and officer CCs was $63,390 in FY 76.

The 71 new and revised SSAS sets, with an average of 13 sheets, accounted for 150,000 copies, or 1,950,000 impressions in FY 76, at a cost of $96,725. Also in FY 76, 213,700 SSAS sets were reprinted at a cost of $71,025 for the 2,778,100 impressions.

The total printing load in FY 76 for reprint, new, and revised CCs and SSASs amounted to 30,890,250 impressions at a cost of $278,440.

ADVANCEMENT IN RATE EXAMINATIONS

AUTHORING. The AREs are authored in the NETPDC at Pensacola by the writing branch responsible for the related RTM and CC. Except for the E-3 examinations, which are administered at the local level, the exams are administered at the same time Navy-wide either once (E-7 thru E-9 examinations) or twice (E-4 thru E-6 examinations) a year. Each administration of an exam for a particular rate within a rating requires a new exam to ensure equal opportunity to all examinees. Consequently, 788 new examinations are required annually.

An exam typically has 150 questions and is "written for oblivion"; i.e., written with no intent for reuse. The questions, each with about 275 characters, are contained on about 14 pages to which are added 3 pages of front and back matter to bring the examination size to a total of 17 pages and about 50,000 characters. An average of 142 man-hours per examination is expended in test planning, selecting test items, and writing new test items prior to the initial encoding. Thus, the authoring load for the 788 AREs published annually is 39,400,000 characters at an expenditure of 111,896 man-hours (56 man-years).

ENCODING. Because each examination is new and not merely a revision of the earlier examination, it must be encoded in its entirety. It requires 13 typist hours to encode the 50,000 characters of an average examination. In addition to the examination itself, the encoding of the 5,550 characters of supportive and control data requires an additional 3 man-hours. Thus the total encoding load per examination is 55,550 characters at an expenditure of 16 man-hours. This equates to an annual encoding load of 43,773,400 characters at an expenditure of 12,608 man-hours (6.3 man-years).

EDITING. Proofreading and verifying the examination and the supporting control documentation requires 24 man-hours. Only about 5 percent of the 55,550 characters require correcting or changing and this is accomplished by the typist with the expenditure of 3 man-hours. For the 788 AREs the annual editing load is thus 2,188,670 characters at an expenditure of 18,124 professional staff man-hours (9 man-years) and 2,364 typist-hours (1.2 man-years).

COMPOSITION. Like the PQSs and the CCs, the AREs are not "composed" as a separate function. The questions are merely composed on the pages by the typist as they are typed. If a separate composing function were performed, it would require the composition of 50,000 characters per examination for an annual composing load of 39,400,000 characters.

ILLUSTRATING. The AREs are lightly illustrated with an average of about five line drawings per examination. The illustration requires 3.5 man-hours of preparation and another .5 man-hours for paste-ups in the examination. Thus the illustrating load is five illustrations and 4 man-hours per examination. This equates to an annual illustrating load of 3,940 illustrations and 3,152 man-hours (1.5 man-years) for the 788 examinations.

TYPESETTING. The typesetting of the AREs is currently accomplished by the typists in the writing branches as a part of the encoding function. If typesetting were to be accomplished as a separate effort, it would require the setting of 50,000 characters per examination or a total of 39,400,000 characters annually.

PLATEMAKING. The few illustrations contained in the AREs are line drawings which are pasted-up by the writing branches. Therefore, no special illustration negatives are required. The 788 examinations average 17 pages each, resulting in a platemaking load of 13,396 negatives and plates.

PRINTING. Annually, 600,000 copies of AREs are printed. With an average of 17 pages each, this amounts to a printing load of 472,800,000 impressions at a cost of $175,000.

INSTRUCTIONAL PROGRAM DEVELOPMENT MATERIALS

The first IPDC had not as of June 1977 published any courseware. The loadings of the various functional elements are, therefore, projections based upon the requirements of similar publishing efforts. Each IPDC is to produce 1,000 hours of courseware per annum, with each hour requiring an average of 12 pages to be delivered to the student.

AUTHORING. It is estimated that the pages will contain an average of 2,100 characters. Thus the annual load per IPDC will be 25,200,000 characters and, based upon similar publishing efforts, 50,600 man-hours (25.3 man-years). When all five centers are in operation the total annual load will be 126,000,000 characters.

ENCODING. All of the new materials will require encoding. Thus, the annual encoding load per IPDC is estimated to be 25,200,000 characters and would require about 2,200 typist-hours (2.2 man-years).

EDITING. An editing load of 10 percent is estimated. This will result in an initial annual editing load of 2,520,000 characters and an ultimate annual editing load of 12,600,000 characters for five IPDCs with an estimated 4,600 professional man-hours (2.3 man-years) and 1,800 typist-hours (0.9 man-years) required per IPDC.

COMPOSING. Like the PQSs, CCs, and AREs, the IPDMs are not "composed" as a separate function. If a separate composing function were performed, it would require the composition of 25,200,000 characters annually per IPDC, and 126,000,000 characters annually when all five IPDCs are in operation. Using current techniques, this would require an effort of about 5,000 typist-hours (2.5 man-years) to compose.

ILLUSTRATING. It is estimated that every third page of IPDMs will have an illustration. Thus the initial illustrating load will be 4,000 illustrations for the first IPDC and will ultimately increase to a loading of 20,000 illustrations annually. It is estimated that this will require an effort of 22,000 man-hours (11 man-years) per IPDC or a total of 110,000 man-hours (55 man-years) when all five IPDCs are operational.

TYPESETTING. The typesetting of the IPDMs is currently planned to be accomplished by the typists as a part of the encoding and editing functions. If typesetting were to be accomplished as a separate effort, it would require the setting of 25,200,000 characters annually for each IPDC. When five IPDCs are operational, this would amount to 126,000,000 annually.

PLATEMAKING. There will be a basic requirement for 12,000 plates per IPDC. In producing them, a high number of illustrations will require screening. Initially, there will be an annual requirement for 12,000 text negatives, 4,000 illustration negatives, and 12,000 plates. When all five IPDCs are in operation this will have increased to 60,000 text negatives, 20,000 illustration negatives, and 60,000 printing plates annually.

PRINTING. Assuming an average of 9,000 copies each, 12,000 pages will result in an annual printing load of 108,000,000 impressions for each IPDC. If all five IPDCs become operational, the printing load will be 540,000,000 impressions annually.

SECTION IV

PUBLISHING SYSTEM OPTIONS

This section defines five viable alternatives to the current publishing system for meeting the CNET publishing requirement.

An important feature of this publishing requirement is the wide geographical separation of the various authoring sites imposed as a function of the responsible commands. Having remote authoring sites poses problems in communications and logistics in getting the authored text to the composer; yet, because of the hardware expense, it is not practical to perform the tasks of composing and typesetting at each authoring site. By 1980, it is anticipated that the system will consist of: NETPDC in Pensacola; PQSDD in San Diego; and two IPDCs, one in San Diego and a second in Great Lakes. Although an additional three, for a total of five IPDCs, have been proposed, the time of implementation, if at all, remains in question for these additional sites. It has been assumed, therefore, that the IPDC publishing requirements will remain constant, encompassing two sites, throughout the 1980s. As will be seen, however, additional growth would merely shift the balance toward the larger, more sophisticated computer based systems.

The number of different encoding, editing, composing, and typesetting options combined with the number of authoring sites allows for a very large number of possible alternatives. However, the hardware cost of system elements rules out most of these as being economically impractical. Five viable alternatives to the current system, each of progressively increasing sophistication, have been configured, and are presented here: A matrix of the current system and the alternatives with their respective elements is shown in table 7. The interested reader is referred to appendix C for a discussion of hardware components typically used in publishing systems.

THE CURRENT PUBLISHING SYSTEM

One option is to continue to use the current publishing system and techniques. This system has already been described in detail in section II and will not be discussed here.

ALTERNATIVE 1 - THE WORD PROCESSOR BASED SYSTEM

An obvious improvement to the system would be to replace the typewriters in the authoring branches at the NETPDC with VDT type word processors equipped with floppy discs. This would result in a total word processor based system, in that each authoring site would be employing some form of word processing equipment utilizing a magnetic storage medium. It is estimated that a 50 percent labor savings in the encoding effort at NETPDC will accrue primarily through the reuse of previously encoded text stored on the floppy discs, and to a lesser extent as a result of the reduced paper handling and end-of-line judgments eliminated by the use of VDT type word processors. Another savings

TABLE 7. PUBLISHING SYSTEM OPTIONS

System Options	Current System	Alternative Systems 1	2	3	4	5
Type of System	Traditional	Word Processing	Advanced Word Processing	Advanced Word Processing with Typesetter	Text Editor	Text Editor with Scanned Graphic
Encoding/Editing Equipment						
PQSDD	Mag-Card IIs	Mag-Card IIs	VDTs	VDTs	Text Editor	Text Editor
IPDCs	VDTs	VDTs	VDTs	VDTs	Text Editor	Text Editor
NETPDC	Typewriters	VDTs	VDTs	VDTs	Text Editor	Text Editor
Composing Equipment						
PQSDD	Mag-Card IIs	Mag-Card IIs	VDTs	-	-	-
IPDCs	VDTs	VDTs	VDTs	-	-	-
NETPDC	MTSCs & Typewriters	MTSCs & VDTs	MTSCs & VDTs	Stand-Alone Composers	Cluster Type Composition System	Cluster Type Composition System
Typesetting Equipment						
PQSDD	Mag-Card IIs	Mag-Card IIs	VDTs	-	-	-
IPDCs	VDTs	VDTs	VDTs	-	-	-
NETPDC	MTSCs & Typewriters	MTSCs & VDTs	MTSCs & VDTs	Typesetter	Typesetter	Typesetter with Digitized Graphic Option

is anticipated to occur in the code editing which follows the review editing. A 75 percent reduction in the labor required for code editing is anticipated because the necessity to rekeystroke unchanged text will be removed. Applying these labor savings, it is estimated that nine VDT type word processors would meet the current encoding and editing requirement at NETPDC.

ALTERNATIVE 2 - THE ADVANCED WORD PROCESSOR BASED SYSTEM

Following the introduction of word processors to NETPDC, the next step in the progression of sophistication would be to replace the outdated mag-card word processors at PQSDD with VDT type word processors equipped with floppy discs. It is estimated that 10 percent savings in the encoding effort would result due to the reduction in mag-card handling, paper handling, and end-of-line decisions. A 50 percent reduction in the editing effort will result from the greater accessibility brought about by the VDT and the larger capacity of the floppy discs, one of which may contain the equivalent text of 100 mag-cards. Applying these labor savings, it is estimated that four VDT type word processors would meet the current encoding and editing requirement of the PQSDD.

ALTERNATIVE 3 - THE ADVANCED WORD PROCESSOR BASED SYSTEM WITH A TYPESETTER

Having followed a path leading to the utilization of VDT type word processors for all encoding and editing, the next logical functions to be considered for the application of modern technology are those of composing and typesetting. A sample of current PQS, RTM, and CC materials was composed and typeset on a phototypesetter with an average original page savings of 37 percent. Based upon the current printing requirements, the introduction of typesetting could be expected to decrease the total number of text negatives by 32 percent, the number of plates by 25 percent, and the total number of pages by 26 percent. (Appendix A contains examples of materials in typeset and nontypeset formats.) Text that is to be typeset by a phototypesetter must first be composed by a device which adds the necessary typesetting codes. It is anticipated that the high degree of standardization of composition formats which exists in the CNET SUPPORT publications will permit stored formats to be used to great advantage, particularly for the PQSs, CCs, and AREs. Thus, it is estimated that an operator, utilizing a stand-alone composition system which accepted word processor floppy discs as input could compose publications at the rate of one publication every 4 hours for the PQS, CC, and ARE type publications. The RTMs and IPDMs, because of their length and generally less standardized formats, would take considerably longer--an estimated 32 hours per publication. Based upon these assumptions, four composition system terminals would be required for the annual composing load of 1,107 publications. The output of the composition system would be magnetic tape containing the typesetting code necessary to drive a phototypesetter. One highspeed phototypesetter will more than meet the typesetting requirement. The output of the typesetter would be film negatives of fully composed and typeset pages.

ALTERNATIVE 4 - THE TEXT EDITOR BASED SYSTEM

Multiterminal text editors consist of a minicomputer CPU for control, a fixed disc for storage, multiple terminals for encoding/editing, and a tape drive for input and output, and, usually, a printer for making proof copies. Their use constitutes a major departure from the stand-alone encoding and editing terminals considered thus far. Because a text editor system has a minicomputer as a controller, it offers more powerful editing functions and has inherently greater flexibility. Thus, a labor savings of 10 percent in the editing effort may be expected. Furthermore, a text editor system with a CPU, 4 text input and editing terminals, a 10 mega-byte disc for on-line storage, a printer for hardcopy review, and a tape drive for input of document files from archival storage and output to the composition system is competitive, in terms of cost, with 4 stand-alone word processors. For larger installations the cost advantage is with the minicomputer based text editor system. A four terminal system is proposed for each of the remote authoring sites (PQSDD, IPDC(SDO), and IPDC(GL)), and a similar nine terminal system is proposed for the principal authoring site, NETPDC. Corresponding to the multiterminal text editors, a multiterminal composition system with its CPU, six composing terminals, a high speed printer, and tape drive for input of text tapes from the text editor systems and output of tapes containing text and typesetting commands to the typesetter is proposed. This multiterminal composition system would cost considerably less than the four stand-alone composers specified in Alternative 3 and provides greater flexibility. The typesetter proposed is the same as that used with Alternative 3.

ALTERNATIVE 5 - THE TEXT EDITOR BASED SYSTEM WITH GRAPHIC SCANNER

The elements of this option are the same as those proposed in Alternative 4 with the addition of a graphic scanner. With a capability for digitizing halftones and line drawings it approaches most closely the state-of-the-art in publishing technology and eliminates the added costs for making separate halftone negatives and line drawing negatives. Balancing the added cost of separate negatives for graphics is the cost of the graphic scanner and its operating costs. A graphic scanner is offered by one vendor as an accessory to the phototypesetter. This is particularly attractive because it avoids the acquisition of duplicate components in two pieces of equipment. The dual use of the typesetter is made possible by its inherently high speed which will permit it to accomplish both functions without interference.

SECTION V

COST ANALYSES OF THE PUBLISHING SYSTEM OPTIONS

This section of the report analyzes the costs associated with the current and proposed publishing systems. Presented first are the assumptions necessary for performing the cost analyses of each option. Following these assumptions, a summary of the analyses is provided in summary tables as a means of comparing the effectiveness of each alternative system. Finally, a discussion of the overall costs and risks associated with each option provides a synopsis of these analyses.

ASSUMPTIONS

For ease in reference, the assumptions are listed under the functions to which they apply.

LABOR. It is assumed that the labor costs for the various skill levels involved will remain constant over the 10-year period at the levels listed in table 8.

TABLE 8. LABOR COSTS BY SKILL LEVEL*

Skill Level	Man-Year Cost
Authoring (authoring/review editing)	$21,248
Typist (encoding/code editing)	$8,499
Composer (composition/layout)	$10,245
Illustrator (illustrating)	$17,998

*Derived Using Navy Billet Cost Model

Authoring. It is assumed that the labor involved in the authoring functions will not be significantly affected by the system alternatives.

Encoding. The following assumptions apply to labor associated with the encoding function:

1. The use of VDT word processors in lieu of typewriters at NETPDC (Alternative 1) will result in a 50 percent reduction in the encoding effort due to the large amount of reused materials, reducing the 13.9 man-year requirement to 7.0 man-years.

2. Replacing the Mag-Card II word processors with VDT word processors (Alternative 2) will reduce the labor involved in encoding by 10 percent or .3 man-years at PQSDD.

3. The use of a text editor system (Alternative 4) instead of VDT word processors will not significantly affect the labor required for encoding.

Review Editing. It is assumed that the labor required in the review editing function will be unaffected by any of the proposed system alternatives.

Code Editing. The following assumptions have been made with regard to the labor in the code editing function:

1. The use of VDT word processors in lieu of typewriters at NETPDC (Alternative 1) will result in a 75 percent reduction in the 6.1 man-years to 1.6 man-years of labor required for code editing at NETPDC.

2. The replacing of the Mag-Card II word processors at PQSDD with VDT word processors (Alternative 2) will result in a 45 percent reduction in the code editing labor of 3.6 man-years required at PQSDD.

3. The use of the text editor systems in place of VDT type word processors (Alternative 4) will result in a 10 percent savings in the 5.4 man-years of labor required for code editing by alternative 2 and 3.

Composing. The following assumptions apply to the labor associated with the composing function.

1. The introduction of automated composition to all publications (Alternative 3) in place of the limited composition accomplished using MTSTs and MTSCs will result in a new labor requirment of 3.6 man-years for composing.

2. The implementation of a multiterminal composition system (Alternatives 4 and 5) will affect a 10 percent savings over the 3.6 man-year requirement of the stand-alone compositors (Alternative 3).

Typesetting. The use of a high-speed typesetter, as proposed in Alternatives 3, 4, and 5 will require .5 man-years of labor to operate, including the processing of its film output.

Illustrating. It is assumed that the operation of the digitizing graphic scanner proposed in alternative 5 will increase the labor required in the illustrating function by .5 man-years. None of the other alternatives will affect the illustrating function.

PLATEMAKING. It is assumed that the unit costs for the platemaking function will remain constant over the 10-year period of analysis at the values listed in table 9.

TABLE 9. UNIT COSTS FOR PRINTING SERVICES*

Text negatives	$1.05	/negative
Line-drawing negatives	.90	/negative
Halftone negatives	2.70	/negative
Plates	.60	/plate
Paper	.56	/100 sheets (.0028/page)
Printing	.0005	/page
Folding	.0008125	/page
Collating	.00125	/page
Binding	.03	/binding

*This information is derived from NAVSO 3518, Printing (NPPSOEASTDIV Rev. 12/76), and applies to the use of 35 X 22 press runs.

Text Negatives. A reduction of 32 percent of the numbers of text negatives required is assumed will result from the use of sophisticated composition and phototypesetting proposed for Alternatives 3, 4, and 5. This is based upon the results of a sample of PQS, RTM, CC, ARE, and IPDM publications which were composed and typeset with an average savings of 37 percent (see appendix A).

These savings were approximately 50 percent for PQS and IPDMs, 10 percent for RTM materials and 25 percent for CC and ARE materials. Using these figures and the number of text negatives required for each type publication in the current system (reference table 4) results in 32 percent savings.

Line Drawing Halftone Negatives. The use of digitized graphics (Alternative 5) will obviate the need for preparing separate illustration negatives (with the exception of color negatives, whose numbers are insignificant).

Plates. It is assumed that the number of plates required will be reduced by 25 percent by implementation of composition and phototypesetting (Alternatives 3, 4, and 5). This is based upon the savings in original pages due to typesetting for the various materials and the number of reprints required for each.

PRINTING. The assumed savings in printing costs are the result of applying the savings assumed in text negatives under platemaking to the printing requirements for each type publication presented in table 4, in conjunction with the unit costs represented in table 9. No savings was assumed for binding since the same number will be required even though the overall thickness of each publication will become smaller.

EQUIPMENT REQUIREMENTS. Using the man-year requirements resulting from the assumptions made for the labor required for encoding/code editing and composing, the following assumptions resulted.

1. The 20 typewriters required by NETPDC for encoding and code editing could be replaced by nine VDT terminals (either word processors or text editor based).

2. The seven Mag-card II word processors required by PQSDD could be replaced by four VDT terminals.

3. The cost of additional text editor terminals ($3,000) is so small that an additional terminal at each IPDC to meet peak demands and to aid in the task analysis function is justified for Alternatives 4 and 5.

4. The automated composition proposed in Alternatives 3, 4, and 5 may be accomplished using four composing terminals, but the cost of additional composing terminals ($6,000) justifies the acquisition of two additional composing terminals at NETPDC to aid in meeting fluctuating demands in the composing encoding and code editing functions.

5. At least three second-generation phototypesetters would be required to meet the typesetting needs proposed by Alternatives 3, 4, and 5 and would cost more in capital investment, maintenance, and operating costs than one third-generation high speed typesetter. A third-generation typesetter is a prerequisite for the digitized graphics proposed in Alternative 5 and is further justified by its microfilm capabilities.

6. One graphic scanner will more than suffice for both the line drawing and halftone digitizing requirements of Alternative 5. The convenience of having this capability in-house, rather than having to wait for it to be processed out-house, is justification for acquisition of the scanner in Alternative 5.

EQUIPMENT COSTS. The equipment components required by the current and alternate systems have been listed in table 7. It is assumed that none of the currently owned publishing equipment will be disposed of if an alternative system is implemented. Therefore, no capital investment is recoverable. Some, or all, of the rental and maintenance charges shown in table 10, however, would be eliminated dependent upon the alternative chosen. The assumed costs for the equipment components required by the alternative systems are listed in table 11 and are based on estimates provided by equipment vendors. Items for which a rental charge was not available but for which a capital investment value existed were listed with their capital investment values along with their annual costs based upon a 10-year lease agreement. (The monthly rate of .01613 times the capital investment value was used in these calculations.[1])

[1] Federal Leasing, Inc., Midlothian, VA, ltr WVB:bak of September 9, 1977.

TABLE 10. EQUIPMENT EXPENDITURES FOR THE CURRENT SYSTEM

TYPE CHARGE	DEVICE	UNIT COST	UNITS	ANNUAL COST
Rental/Lease	Mag-Card II	$310/mo	7	$26,040
	VDT Word Processors	$610/mo	6	43,920
	MTSCs	$380/mo	2	9,120
	MTST	$280/mo	4	13,440
	Head Liner	$277/mo	1	3,324
Maintenance	MTSC	$1,120/yr	1	1,120
	MTST	$ 716/yr	3	2,148

TABLE 11. COST OF ALTERNATE EQUIPMENT COMPONENTS

DEVICE*	UNIT COST	ANNUAL COST	ANNUAL MAINTENANCE
VDT Word Processor (Vydeck)	$610/mo	$7,320	--
4-Terminal Text Editor (Atex 8000)	77,000	14,904	$6,930
9-Terminal Text Editor (Atex 8000)	92,000	17,808	8,280
Stand-Alone Composer (IMLAC)	60,000	11,614	5,400
6-Terminal Composition System (Atex Composition System)	158,500	30,679	14,265
Photo Typesetter (Autologic APS 5)	100,000	19,356	7,920
Graphic Scanner (Autologic Scanner)	60,000	11,614	5,700

*The name in parentheses indicates the device actually used for deriving the costing information, but does not constitute an endorsement of that equipment.

It is assumed that the lead time required to obtain the capital investment funds for equipment purchase would exceed 2 years, while leasing could be implemented within a few months. Leasing, however, will cost approximately twice as much as purchasing the equipment. Since the annual savings expected with the alternative system will equal three times the equipment costs, the additional costs associated with leasing the equipment will be recovered within 4 months of operation. Therefore it is recommended that the equipment be leased.

TOTALS. The following assumptions apply to the summed total costs and present value costs.

Total Cost. The total cost value assumes that the costs derived for the listed functions represent the total costs associated with the publishing of the CNET training publications.

Present Value Costs. The amount of money which would be required to be set aside in order to meet annual expenses over the period of analysis, taking into account the interest which might be earned if expenditure is delayed, is referred to as present value cost. Where different capital investments and annual expenditures are involved, present value costs provide a convenient measure for comparison. The present value costs were arrived at by applying a 10 percent discount rate for all future year costs to the annual "total cost" figures as specified by DOD Directive 7041.3 for each of the years in the 10-year period of analysis.

SUMMARY OF THE ANALYSES

PRODUCTION REQUIREMENTS. The annual production requirements were analyzed for each of the alternatives using the current requirements for CNET publishing functions contained in table 5 and the assumptions presented in this section. The results of these analyses are summarized in table 12.

MANPOWER REQUIREMENTS. The manpower requirements for each alternative based upon the current CNET manpower requirements for publishing functions listed in table 6 were calculated by applying the assumptions regarding labor presented in this section. A summary of these analyses appears in table 13.

SUMMARY OF COSTS. The labor costs for each alternative were calculated using the assumed labor costs contained in table 8 and the manpower requirements presented in table 13. The platemaking and printing costs were calculated by applying the costs assumed in table 9 to the production requirements for each function presented in table 12. Equipment costs for the current system were calculated by using the recoverable expenditures of the current system represented in table 10. The alternative systems' equipment costs were calculated using the equipment component costs presented in table 11 and the component elements required by the assumptions made in this section. The results of these calculations are summarized in table 14.

TABLE 12. SUMMARY OF ANNUAL PRODUCTION REQUIREMENTS FOR PUBLISHING FUNCTIONS

	Units	Current System	Alternative 1	2	3	4	5
Textual & Graphic Data							
Authoring	Million Char.	162.5	162.5	162.5	162.5	162.5	162.5
Encoding (Code)	"	162.8	162.8	162.8	162.8	162.8	162.8
Editing (Review)	"	162.8	162.8	162.8	162.8	162.8	162.8
Editing	"	19.6	19.6	19.6	19.6	19.6	19.6
Composing	"	48.0	48.0	48.0	177.2	177.2	177.2
Typesetting	"	-	-	-	177.2	177.2	177.2
Illustrating	Thousand Illus.	17.4	17.4	17.4	17.4	17.4	17.4
Platemaking							
Text Negatives	Thousand Neg's	72.7	72.7	72.7	49.2	49.2	49.2
Line Drawing Negatives	"	3.0	3.0	3.0	3.0	3.0	-
Halftone Negatives	"	9.8	9.8	9.8	9.8	9.8	-
Plates	Thousand Plates	100.2	100.2	100.2	74.9	74.9	74.9
Printing							
Paper	Million Pages	1080.4	1080.4	1080.4	799.7	799.7	799.7
Printing	"	1080.4	1080.4	1080.4	799.7	799.7	799.7
Folding	"	1080.4	1080.4	1080.4	799.7	799.7	799.7
Collating	"	1080.4	1080.4	1080.4	799.7	799.7	799.7
Binding	Thousand Bindings	3803.1	3803.1	3803.1	3803.1	3803.1	3803.1
Equipment							
Encoding/Editing Devices	Terminal	33	22	19	19	21	21
Composing Devices	Terminal	.7	.7	.7	.4	.6	.6
Typesetters	Type-setters	-	-	-	1	1	1

TABLE 13. SUMMARY OF TOTAL ANNUAL MANPOWER REQUIREMENTS FOR PUBLISHING FUNCTIONS

	Units	Current System	Alternative 1	2	3	4	5
Authoring	Man-Years	306.7	306.7	306.7	306.7	306.7	306.7
Encoding	"	20.9	13.9	13.6	13.6	13.6	13.6
Editing (Review)	"	31.8	31.8	31.8	31.8	31.8	31.8
Editing (Code)	"	11.5	7.0	5.4	4.9	4.9	4.9
Composing	"	4.9	4.9	4.9	3.6	3.3	3.3
Typesetting	"	-	-	-	.5	.5	.5
Illustrating	"	38.7	38.7	38.7	38.7	38.7	39.2

TABLE 14. SUMMARY OF ANNUAL COSTS FOR PUBLISHING FUNCTIONS (X$1000)

	Current System	Alternative 1	2	3	4	5
Labor						
Authoring	6,517	6,517	6,517	6,517	6,517	6,517
Encoding	178	118	116	116	116	116
Editing (Review)	676	676	676	676	676	676
Editing (Code)	98	59	46	46	42	42
Composing	50	50	50	37	34	34
Typesetting	-	-	-	5	5	5
Illustrating	696	696	696	696	696	705
Platemaking						
Text Negatives	76	76	76	52	52	52
Line Drawing Negatives	3	3	3	3	3	-
Halftones	36	26	26	26	26	-
Plates	60	60	60	45	45	45
Printing						
Paper	3,025	3,025	3,025	2,239	2,239	2,239
Printing	540	540	540	400	400	400
Folding	877	877	877	649	649	649
Collating	1,351	1,351	1,351	1,000	1,000	1,000
Binding	114	114	114	114	114	114
Equipment						
Rental/Lease	96	162	165	231	113	124
Maintenance	3	3	3	30	51	57
Totals						
Total Cost	14,386	14,354	14,342	12,880	12,777	12,773
Present Value Cost for 1980-1989	92,814	92,609	92,532	83,099	82,435	82,412

DISCUSSION

The present value costs presented in table 14 provide a means for ranking the publishing system options. Table 15 presents these options in order from least to most costly.

Each of these options has associated with it, in addition to the strictly economic cost, a degree of risk. The current system seemingly has little risk because it already exists. However, it also has the heaviest labor requirement and is consequently the most vulnerable to rising labor costs. Alternatives 1 and 2 share with the current system the heaviest printing loads, which are vulnerable to increasing costs both in terms of labor and material. Alternatives 3, 4, and 5, while offering significant savings in terms of present value costs, require a substantial commitment in terms of a typesetter and composing equipment. Finally, the graphic scanner proposed in Alternative 5 has yet to be proven over time.

Based upon the present value costs and the risks associated with each option, Alternative 4 is believed to be the most cost effective for the risks involved. This is because, in addition to the existence of similar text editor based systems which have been proven over time, the minicomputer based systems offer greater flexibility in that they are upgradable through software changes.

TABLE 15. PUBLISHING SYSTEM OPTIONS RANKED BY PRESENT VALUE COSTS

RANK	OPTION	PRESENT VALUE COST
1	Alternative 5 - Text Editor Based System with Graphic Scanner	$ 82,412,000
2	Alternative 4 - Text Editor Based System	82,435,000
3	Alternative 3 - Advanced Word Processor Based System with Typesetter	83,099,000
4	Alternative 2 - Advanced Word Processor Based System	92,532,000
5	Alternative 1 - Word Processor Based System	92,609,000
6	Current System	92,814,000

SECTION VI

RECOMMENDATIONS

The economic analysis of the current CNET publishing system and the five alternatives shows a computer based Text Editor and Composing System with Typesetter (Alternative 4) to be the most viable option. When compared with the cost of operating the present system, the proposed system equipment costs can be amortized in the first year with attendant savings of over $1.1 million. Savings in excess of $1.7 million could be realized in each subsequent year.

Detailed recommendations for each function in the proposed system are provided below in a recommended order of implementation.

ENCODING AND EDITING: <u>Lease a TEXT EDITOR SYSTEM for each of the four authoring sites; PQSDD - San Diego, NETPDC - Pensacola, IPDC - San Diego, and IPDC - Great Lakes.</u>

A nine terminal text editor system will be required for the authoring branches at NETPDC and a four terminal text editor system will be required at each of the other three authoring sites. Although the present value costs will be slightly higher if the equipment is leased rather than purchased, the savings in production costs due to earlier implementation will more than offset the additional costs for leasing. (This same logic is the basis for recommending that other components of the overall system be leased.)

COMPOSITION: <u>Lease a six terminal composition system for use in composing the PQs, RTMs, CCs, AREs, and IPDMs and install the system in the Production Branch of NETPDC.</u>

To minimize the disruption of current work flow while implementing automated composition, and to ensure maximum savings in printing costs, the transition should be scheduled as follows. Prepare the protocols for composing the RTMs first. When these have been completed, proceed with developing the formats for the PQSs, IPDMs, CCs, and AREs in that order. Following this schedule, all of the standard formats necessary for automated composition should be completed within 6 months.

TYPESETTING: <u>Lease a high speed third generation phototypesetter and install it in the Production Branch of the NETPDC.</u>

All materials that have been composed by the composition system will be sent to the phototypesetter. Since the typesetter will only accept material which has been composed and formatted to drive the phototypesetter, its use is dependent upon the development of the formatting protocols required for the composition system. The saving of $16.1 million over 10 years of system use is heavily dependent upon the combined use of the composing and phototypesetting equipment.

After the text editing, composing and phototypesetting systems are in full operation, additional savings may be possible. At that time the following recommendation should be implemented.

GRAPHICS: Conduct a cost analysis of digitized graphics systems to determine if such a system is practical and cost effective for CNET.

Equipment to support digitized graphics, as proposed in Alternative 5, is available today, but little data have been compiled on its operation. Within a year, detailed information on the performance and operating costs of two or more operating systems will be available. Since the digitized graphics capability can be added as an accessory to the typesetter, a delay in selecting this option will not seriously affect system cost and will reduce the risk involved with this decision.

Before any of these recommendations may be implemented, approval from the Navy Publications and Printing Service Office (NPPSO) and the congressional Joint Committee on Printing (JCP) must be obtained. Preliminary discussions with personnel from the NPPSO and Government Printing Office (GPO) indicate that this approval can be obtained with the supporting justification presented in this report.

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APPENDIX A

SAMPLES FROM PERSONNEL QUALIFICATION STANDARDS, RATE TRAINING MANUALS AND INSTRUCTIONAL PROGRAM DEVELOPMENT MATERIALS

Sample pages from CNET SUPPORT training materials have been typeset so that a comparison may be made between the currently published output and typeset output. Examples of pages from a Personnel Qualification Standard (PQS), Rate Training Manual (RTM), and Instructional Program Development Material (IPDM) produced by the current publishing system, are presented in figures A-1, A-3, and A-5 respectively, while examples of the same materials in typeset form are presented on the facing figures, A-2, A-4 and A-6.

In comparing figures A-1 and A-2 it is readily apparent that typesetting permitted printing a little more than twice the amount of text from a PQS on the page, as compared with the current system. (A larger sample resulted in an almost 3 to 1 ratio between the typeset and current PQS materials, but the more conservative estimate of 50 percent page savings was used.) Typesetting, besides accomplishing a page savings which will be reflected in reduced printing costs, has also affected an improved appearance which is both aesthetically pleasing to the eye and easier to read.

Figures A-3 and A-4, comparing RTM material in the current and typeset forms, reveal only a negligible difference between the two, in terms of the page requirement. While it might be argued that the typeset version has a nicer appearance, this is largely a subjective opinion.

Finally, where the IPDM examples are compared in figures A-5 and A-6, a large savings comparable to that found with the PQS is seen. The text ending at the bottom of page 1 in the typeset version appeared on page 4 in the current version. (The conservative estimate of 50 percent savings was again used because of the more complex formatting required in the "Programmed Instruction" section.) Here also, as was the case with the PQS example, typesetting has improved the appearance of the finished product while saving printing costs in the process.

5201 RECEIVER FRONT PANEL CONTROL (R-1903) SYSTEM

5201.1 Explain the function(s) of the RECEIVER FRONT PANEL CONTROL (R-1903) SYSTEM as stated in the Manufacturer's Technical Manual.

.11 Draw a simple sketch of this system from memory using appropriate symbols and showing all components listed in 5201.2 for use throughout this discussion.

5201.2 SYSTEM COMPONENTS

Discuss the designated items for each component listed below:

A. Explain the function(s) of this component in terms of what it does for the system.
B. Show or describe the actual physical location of this component.
C. Discuss the protection provided by this component.
D. List the position(s) and function(s) of each position of this component.

		A	B	C	D
.21	Frequency selector	X	X		
.22	Mode control	X	X		X
.23	Beat frequency oscillator (BFO) control	X	X		
.24	Tune/operate switch	X	X		X
.25	Power on/off	X	X		X
.26	Radio frequency (RF) input attenuator	X	X	X	X
.27	Fault standard indicator	X	X		
.28	Fault receiver indicator	X	X		

5201.3 COMPONENT PARTS

A. There are no component parts in this system to be discussed.

5201.4 PRINCIPLES OF OPERATION

A. There are no principles of operation in this system to be discussed.

5201.5 MAJOR PARAMETERS

.51 State the frequency range.

5201.6 SYSTEM INTERRELATIONS

A. Describe the effect(s) on this system due to the following:

1. Malfunction of antenna patch panel
2. Improper multicoupler selection
3. Wrong selection of frequency standard

Figure A-1. Sample Page from a PQS in Current Form

SYSTEMS

5201
RECEIVER FRONT PANEL CONTROL (R-1903) SYSTEM

.1 **System Function**

.11 Explain the function(s) of the RECEIVER FRONT PANEL CONTROL (R-1903) SYSTEM as stated in the Manufacturer's Technical Manual.

.12 Draw a simple sketch of this system from memory using appropriate symbols and showing all components listed in 5201.2 for use throughout this discussion.

.2 **Systems Components**
Discuss the designated items for each component listed below:

A. Explain the function(s) of this component in terms of what it does for the system.
B. Show or describe the actual physical location of this component.
C. Discuss the protection provided by this component.
D. List the position(s) and function(s) of each position of this component.

		A	B	C	D
.21	Frequency selector	X	X		
.22	Mode control	X	X		X
.23	Beat frequency oscillator (BFO) control	X	X		
.24	Tune/operate switch	X	X		X
.25	Power on/off	X	X		X
.26	Radio frequency (RF) input attenuator	X	X	X	X
.27	Fault standard indicator	X	X		
.28	Fault receiver indicator	X	X		

.3 **Components Parts**
A. There are no component parts in this system to be discussed.

.4 **Principles Of Operation**
A. There are no principles of operation in this system to be discussed.

.5 **Major Parameters**

.51 State the frequency range.

.6 **System Interrelations**
A. Describe the effect(s) on this system due to the following:
1. Malfunction of antenna patch panel
2. Improper multicoupler selection
3. Wrong selection of frequency standard

B. Describe the effect(s) on the following due to the operation of this system:
1. Terminal equipment
2. Receiver monitoring panel in Quality Monitoring Control Panel System

.7 **Safety Precautions**
A. Discuss the safety precautions applicable to this system as specified in the Manufacturer's Technical Manual and OPNAVINST 5100.19.

B. Discuss the safety precautions applicable to each system component of this system as specified in .7A above.

5202
T-1322/SRC TRANSMITTER EXCITER CONTROL UNIT (ECU) SYSTEM

.1 **System Function**

.11 Explain the function(s) of the T-1322/SRC TRANSMITTER EXCITER CONTROL UNIT (ECU) SYSTEM as stated in the Manufacturer's Technical Manual.

.12 Draw a simple sketch of this system from using appropriate symbols and showing all components listed in 5202.2 for use throughout this discussion.

.2 **System Components**
Discuss the designated items for each component listed below:
A. Explain the function(s) of this component in terms of what it does for the system.
B. Show or describe the actual physical location of this component.
C. List the position(s) and function(s) of each position of this component.

		A	B	C
.21	Automatic indicator/switch	X	X	X
.22	Manual indicator/switch	X	X	X
.23	Fault indicator	X	X	X
.24	Frequency selector	X	X	X
.25	Keyed indicator	X	X	X
.26	Operate indicator	X	X	X
.27	Silent tune indicator/switch	X	X	X
.28	Normal tune indicator/switch	X	X	X
.29	Standby indicator/switch	X	X	X
.210	Mode selector	X	X	X
.211	Carrier insert selector	X	X	X
.212	Lamp test switch	X	X	X

.3 **Component Parts**
A. There are no component parts in this system to be discussed.

.4 **Principles Of Operation**
A. There are no principles of operation in this system to be discussed.

.5 **Major Parameters**

.51 State the frequency range.

Figure A-2. Sample Page from a PQS in Typeset Form

CHAPTER 1

THE NAVY YEOMAN

This training manual is designed to help you meet the occupational standards for advancement to Yeoman third or Yeoman second class. The Yeoman standards that were used as a guide in the preparation of this manual are those contained in the Manual of Navy Enlisted Manpower and Personnel Classifications and Occupational Standards, NAVPERS 18068-D, Section I.

The remainder of this chapter gives information on the enlisted rating structure, the Yeoman rating, requirements and procedures for advancement, and references that will help you both in working for advancement and in performing your duties as a Yeoman. This chapter includes information on how to make the best use of rate training manuals. Therefore, it is strongly recommended that you study this chapter carefully before beginning intensive study of the remainder of this manual.

THE ENLISTED RATING STRUCTURE

The two main types of ratings in the present enlisted rating structure, are general ratings and service ratings.

GENERAL RATINGS identify broad occupational fields of related duties and functions. Some general ratings include service ratings; others do not. Both Regular Navy and Naval Reserve personnel may hold general ratings.

SERVICE RATINGS identify subdivisions or specialties within a general rating. Although service ratings can exist at any petty officer level, they are most common at the PO3 and PO2 levels. Both Regular Navy and Naval Reserve personnel may hold service ratings.

THE YEOMAN RATING

The Yeoman rating has a long history in the United States Navy. The title is mentioned in a Navy Register of 1835, and presumably Yeoman duties were performed earlier than that. With introduction of the typewriter and other office machines, methods of performing these duties have changed and the volume of work has increased greatly, but the essential responsibilities have remained the same.

If you look up "Yeoman" in a dictionary, you will find several definitions, one of which is "an assistant." This definition is probably the one responsible for the Navy use of the term, since the Navy Yeoman has always been an assistant to the commanding officer. As ships' organizations and their shore-based support have become more complicated, the field of the Yeoman's activities has expanded correspondingly. Today he serves in nearly every department, afloat and ashore, and his duties as office assistant vary according to the work of the departments.

In whatever office he serves, the Yeoman is a key man. He is, in a very real sense, an assistant to the department head. The degree of accuracy, reliability, and efficiency with which he performs his duties affects the work of all other personnel of the department.

MILITARY RESPONSIBILITIES

In studying for the Yeoman rating, as for any other advancement in the Navy, your first consideration should be the military requirements. These are different in character for a petty officer from the requirements you have met for previous advancement. Their emphasis has changed from knowing how to do certain things as an individual—such as painting or knot tying—to directing and supervising operations performed by others. You still are required to learn some new individual operations for your military requirements, but definitely you are entering the field of military leadership. Your

Figure A-3. Sample Page from an RTM in Current Form

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1

Figure A-4. Sample Page from an RTM in Typeset Form

Prosigns

Part A: Introduction to Lesson

Learning Objective

When you have successfully completed this lesson, you will be able to select from a list of prosigns their meanings and uses as authorized by ACP 126, "Communication Instructions Teletypewriter (Teleprinter) Procedures," Chapter 4, for use in manual teletype communications.

How to Study This Lesson

This lesson contains a Narrative, a Programmed Instruction, and a Progress Check. The Narrative and Programmed Instruction contain the same information, but there are helpful exercises in the Programmed Instruction.

You may take either the Narrative or the Programmed Instruction.

When you have completed the part you chose, take the Progress Check. If you make errors on the Progress Check, go back and review the pages indicated in the feedback.

When you feel you know all the material in this lesson, notify your Learning Supervisor that you are ready for the Post Test.

Figure A-5. Sample Page from an IPDM in Current Form

Prosigns

Part A: Introduction to Lesson

Learning Objective

When you have successfully completed this lesson, you will be able to select from a list of prosigns their meanings and uses as authorized by ACP 126, "Communication Instructions Teletypewriter (Teleprinter) Procedures," Chapter 4, for use in manual teletype communications.

How to Study This Lesson

This lesson contains a Narrative, a Programmed Instruction, and a Progress Check. The Narrative and Programmed Instruction contain the *same* information, but there are helpful exercises in the Programmed Instruction.

You may take either the Narrative or the Programmed Instruction.

When you have completed the part you chose, take the Progress Check. If you make errors on the Progress Check, go back and review the pages indicated in the feedback.

When you feel you know all the material in this lesson, notify your Learning Supervisor that you are ready for the Post Test.

Part B: Narrative

Introduction

Prosigns Speed Communications

Prosigns, or procedure signs, are letters that stand for complete words or phrases frequently used by radiomen. They are used in naval messages to speed communications. Two examples of prosigns are O and T. The precedence prosign O, as you have already learned, means "immediate." The prosign T means "transmit to."

You will learn 30 prosigns in this lesson. You will probably recognize some of them, because they have appeared in the messages you have been copying in typing practice.

Some of the prosigns might appear to be abbreviations, but they are NOT. You are always to call them prosigns.

The prosigns authorized for use in naval teletype communications are listed in ACP 126, "Communication Instructions Teletypewriter (Teleprinter) Procedures," which will be available to you for reference at your duty stations.

Prosigns Grouped by Use

Each of the 30 prosigns has a specific meaning and use. To make it easier for you to learn them, they have been grouped according to their use into seven basic types:

- Precedence
- Message heading
- Calling, ending, and answering
- Message correction
- Message portion identification
- Message handling
- Special

Precedence Prosigns

You have learned the precedence prosigns. So, you have a head start. Here they are again:

Z—flash
O—immediate
P—priority
R—routine

Message Heading Prosigns

This group of prosigns is always used in the heading of a formal message. Each is easy to identify with its use, which will be explained to you.

FM

The prosign FM is the *originator's prosign.*

The originator of a message is the command that sends it. Although the commanding officer is the person who originates the message, his or her name is never used. Instead, the address designation of the unit or command is given as the originator; for instance, the USS Pegasus, a ship.

The address designation of the originator always follows the prosign FM:

FM USS DIXIE

The originator of this message is the USS Dixie.

Figure A-6. Sample Page from an IPDM in Typeset Form

APPENDIX B

AN OVERVIEW OF THE PUBLISHING PROCESS

APPENDIX B

Modern technology is changing the procedures and equipment used in publishing. To understand these changes, a general understanding of information systems in general, as well as the hardware used, is important. This section differentiates between types of information systems and information processors, and indicates those areas in which technology is making the greatest impact upon publishing.

Any publishing system is an information system. Information systems can be divided into two major types: document-based systems, and data-based systems. Information in a document-based system is frozen in format and time. Publishing systems are document-based information systems which form a "bridge of communication between one point in time and another; between the art, ideas, work, knowledge, and insights of certain people and others who may have use of them at some specific later time" (Kalthoff, 1976). Once placed in a publication, document-based information is not expected to be manipulated, massaged, deleted or rearranged. By the way of contrast, data-based information tends to be dynamic, reflecting the current status of a set of variables. A list of enlisted personnel currently enrolled at resident schoolhouses, together with their locations and the courses they are taking, is an example of data-based information.

Just as there are different types of information systems, there are different types of information processors. A computer is an information processor which is frequently used to manipulate, rearrange, massage or delete data-based information to produce new data, new reckonings, and new insights. By way of example, the data-based information described above might be manipulated to provide a list in which the personnel were listed by location.

An "author" is a human information processor which manipulates, rearranges, and massages document-based and data-based information so as to produce new document-based information which will form a new and better bridge of communication. The computer can, and in fact frequently does, manipulate document-based (as well as data-based) information by generating indices or performing data searches. However, the computer is ill-equipped for the task of massaging information into new document-based information to form new bridges of communication; and while the human information processor is capable of handling the data-based information now commonly handled by computers, it is ill-suited to that task in terms of speed and cost effectiveness. In designing an automated publishing system to generate document-based information, it is important to be aware of the fortes and limitations of each of its elements, both man and machine, so that an optimized match may be achieved in the man/machine system.

A publishing system which will produce the type of documents required by the training community must perform a minimum of six labor intensive functions --authoring, encoding, editing, composing, typesetting, and illustrating. A seventh function, platemaking, has traditionally been accomplished by the printer, but because some phototypesetters are capable of making printing plates, this function is also discussed briefly. Each of these functions may require its own set of subfunctions for accomplishment, and, in some instances

the functions overlap. Nevertheless, an attempt is made to describe the seven functions and the impact that new technology is having upon each. Finally, the eighth function, printing, will not be discussed in this section because this has traditionally been and will continue to be a function separate from the CNET publishing system. It should be remembered, however, that printing is a function which contributes to a major part of the publishing process costs and upon which the other functions, particularly that of composing, and typesetting can impact dramatically.

AUTHORING

Authoring is the function in which information is collected from various sources, manipulated and formatted for output in a document-based form for communicating it to others. This function includes three distinct subfunctions: data collection, data manipulation, and data formatting (see figure B-1). The first, data collection, involves the researching and collecting of information from document-based and data-based sources for inclusion in an author's data base. The second, data manipulation, is an information processing function concerned with the manipulating, rearranging, and massaging of the information in this data base into the concepts to be communicated. The third subfunction, data formatting, is the subsequent arrangement of these concepts into document-based information in a form which will communicate the ideas, knowledge, and insights of the author to those who may have use for them at some future time.

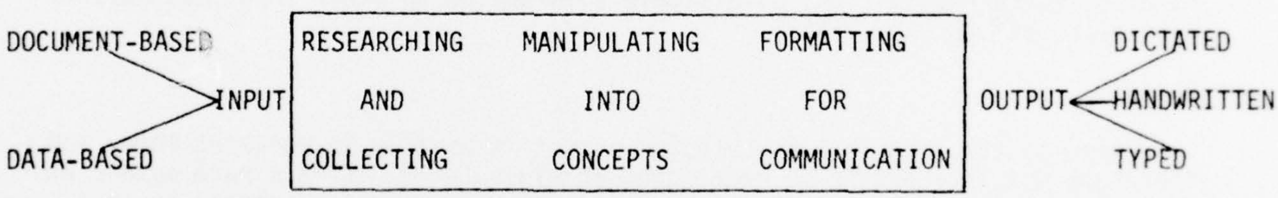

Figure B-1. Information Flow in Authoring

The computer has limited application in the authoring function. As already mentioned, computers, although adept at dealing with data-based information, are not well suited for researching and collecting document-based information. They are sometimes used in "data searches," but these searches merely treat document-based information as though it were data-based information and perform a very rough culling of the data. Computers also lack the processing power necessary to form the data-base into ideas and insights. Finally, they lack, to a large extent, the ability to generate the output format needed to communicate these ideas, insights and knowledge. The computer does have a place in authoring due to its tremendous capability for storing document-based information for selective excerption and insertion by the author in generating new document-based information. This "author controlled" data manipulation will be discussed as a part of the editing function.

ENCODING

An author's output must usually be transformed into another medium regardless of the size of the population to which it is addressed. This transformation may be to a typed medium for increased legibility or to a digital medium for storage and further manipulation by automatic data processors. New technology has not made significant inroads in the encoding process, as yet, and this transformation is usually accomplished manually by a typist, keypunch operator, or some other data keyer, by a process referred to as keyboarding.

Technology appears to be on the verge of impacting this labor intensive function. Devices, called optical character recognizers (OCRs), already exist which are able to electronically scan printed or typed text and automatically encode it in a digital medium. Some OCRs are able to recognize only a special type font, but other more sophisticated OCRs are able to "read" a wide variety of type styles. These devices still require the text to have been keyboarded before they can accept it, and, while they may replace a re-keyboarding operation, re-keyboarding can usually be avoided by keyboarding to a digital medium initially. These devices do, however, suggest the possibility of devices able to recognize handwritten material. Indeed, devices able to recognize handwritten letters and numerals already exist. As this technology develops, the labor involved in the encoding function may be expected to decrease. Another new technology, referred to as voice recognition, may make it possible for materials to be entered directly into a computer's digital data base from a voice input. However, voice recognition, as a viable alternative to other input methods, is many years off (Hughes, 1977).

EDITING

Despite the fact that an author's output is usually in document form, and therefore not intended to be rearranged or manipulated, it is a rare author who is able to write a chapter that does not require some word or phrase to be changed during a quality assurance process. Even if this were not so, the dynamic nature and complexity of Navy weapons systems would necessitate changes. These factors point up the need for an expedient means of making changes to the encoded document.

In the older paper-based system, minor changes, necessitated by spelling or typographical errors, are corrected by obliterating the erroneous code and overstriking it with the correct one. Major changes often require the retyping of an entire page, and, in some instances, several subsequent pages as well. More recent innovations, occasioned by the advent of magnetic tape and magnetic card equipped typewriters, have greatly reduced the labor involved in retyping whole pages. But these innovations have not always saved a great deal of time because after making the changes, the typist must wait for the text to be retyped from the corrected tape.

Newer interactive text editing systems, operating on a digital data base, are now available. With one of these editing systems, any portion of the text may be randomly accessed for display and modification on a video display terminal (VDT). A very powerful feature of these systems is that, because the computer can access a very large memory bank, this "editing" process may access document-based data contained in other documents for inclusion in the document being edited. Thus, if the author would like to include a chapter (or section thereof)

from another document in his document, the computer will copy it where he specifies, obviating the need for it to be re-keyboarded. (The editing system might then be commanded to automatically search and replace all chapter references to correspond with those of the new document.) Such systems are very fast and, as new man-compatible software has been developed, have become very easy to use.

COMPOSING

The composing function is the arranging of the text and graphic materials into a paginated output format preparatory to having the printing plates made. In the traditional system, this is a labor intensive procedure requiring highly skilled persons called compositors. The edited text is first retyped in galley form and the galleys are then cut and pasted up to form composed pages. The spaces required for illustrations are also assigned at this time, but because of the special techniques required for the reproduction of halftones, the actual insertion of the illustrations is usually left to the printer. If, however, the illustrations are line drawings, they are often pasted up along with the text. The labor of pasting up the text materials is sometimes eliminated by keyboarding the galleys on magnetic tape for retyping directly onto the composed page, but this technique adds the time required for the text to be typed from the magnetic tape.

The development of the newer computer based text editing systems, along with larger VDT displays and more powerful software, have made computer based composition possible. The newer VDTs for composition are large enough to display a whole page at a time, allowing full-page composition. Even more important, the powerful software available with these composing systems is capable of translating text from a manuscript format of 80-90 characters/line into composed 2-column pages, each column 20 picas (3-1/3 inches) wide by 600 points (8-1/3 inches) long, right and left justified, and properly hyphenated. The advent of the graphic scanner and reductions in the cost of mass storage of digital data have made it possible for the latest, state-of-the-art, composing systems to handle graphics as well as textual materials. A graphic scanner converts the information contained in the position and various shades of gray for each point of an image into a digital code which is stored in a digital data bank. The digitized graphics data may then be manipulated by a computer for display in a prescribed location along with the text during composition and regenerated with the text during the typesetting function.

TYPESETTING

The term "typesetting" is no longer restricted in use to the manipulation of movable type into place for imprinting. Today, typesetting is more generally understood to mean the preparation of photo-ready copy; i.e., the preparation of the pages in their final form for photographing by the printer in his making of photo-engraved printing plates.

The "typesetting" is sometimes accomplished by typing the final composed form on conventional typewriters. With the fine typing achievable on current office machines, the quality attained is usually adequate. However, the number of styles and sizes of type fonts available on typewriters is limited and

variable spacing between letters, kerning[1] and ligatures[2] are not available. Therefore, phototypesetting equipment, with 100 or more different available fonts, each having a range of sizes, is frequently used. This equipment has the added advantage of being able to generate its output directly on the platemaking material and thus eliminates the loss of resolution that always occurs from one generation to the next in copying. With the increasing use of the micromedia this is of increasing significance. For ordinary printing a small loss of resolution may be negligible; in the micromedia, any loss of resolution becomes important. The very best quality of micrographia in terms of resolution is produced by phototypesetters which generate their output directly on microfilm, a process called computer output microfilming (COM). Many phototypesetters have the ability to generate output in several media--paper, film, photo-engraved printing plates, and microfiche or microfilm.

ILLUSTRATING

Because the printer has the equipment necessary for preparing halftones for reproduction, the handling of illustrations and graphics has traditionally been left to the printer once the size and location of an illustration have been determined in composition. However, because some automated systems are capable of handling graphics, as well as the editing, composing, and typesetting of text, it is important to be aware of the special procedures required for printing graphics. Illustrations may be divided into three classes--line drawings, black and white halftones, and color halftones. Line drawings present few problems, requiring merely to be photographed. The printing of halftones, however, requires screening (i.e., the breaking down into elemental dot matrices) because the printing presses cannot actually vary the level of gray but create that illusion by varying the size of each dot. Black and white halftones require one screening, and color illustrations typically require four. The optimum size for the screening grid, which controls the grid size of the dot matrix, is dependent upon the texture of the paper but is usually around 90 lines per inch for most CNET publications.

Graphics may also require special techniques when COM is used. If a phototypesetter supporting digitized graphics is used, the graphics may be generated for output at the same time as the text. A more usual method in the absence of digitized graphics is to optically insert the image with the text by flashing it onto the film after the typesetting has been done.

PLATEMAKING

As already mentioned, many modern phototypesetters generate output in several media--including photo-engraved printing plates. However, because the traditional output from the typesetters is photo-ready copy, the platemaking process will be discussed.

[1]Kerning - the reduction of the space between certain letter pairs; e.g., V and A (VA).

[2]Ligature - a combination of characters which are printed as one graphic; e.g., ff, ffi, ffl, fi, fl.

In the traditional system, photographic negatives are made of the textual material. A photographic reduction of the text size may also be performed at this time if it is required. Photographic negatives of the halftones are then made through a screen which breaks the image up into a matrix of dots. Any reduction or cropping (the cutting off of a side) of the illustrations is also done at this time. The platemaker then cuts the spaces or "windows" out of the textual unscreened negatives and cuts and inserts the screened negatives to match. The resultant composite negative is used to expose the photo-sensitive plate-material which, after processing, becomes the actual printing plate.

The overlapping of functions can be seen here. If the most modern of composing and phototypesetting equipment has been used, the output of the typesetter may be photo-engraved plates ready for the printing presses. On the other hand, if a phototypesetter incapable of handling graphics has been used, then photographing and screening of the illustrations (in lieu of optical scanning), "cutting in" of the screened and unscreened negatives and making of a photo-engraved plate will be required. Finally, the traditional system will require photographing of both the textual (unscreened) material and graphics (screened) material, the "cutting in," and the photo-engraved platemaking processes.

APPENDIX C

PUBLISHING SYSTEM EQUIPMENT OPTIONS

APPENDIX C

A number of different options are available in the selection of the equipment to be used in any publishing system. Not only hardware costs, but its ease of use and relationship to other equipment components are important. The following paragraphs describe briefly various equipment components available for use in the CNET publishing system, the functions for which they are applicable, and the relative merits of their use in accomplishing that function.

MONOSPACED TYPEWRITER. This is the conventional office typewriter. It is versatile in that it may be used in the encoding, editing, and composing functions. Figure C-1 depicts the information flow in a monospaced typewriter system. In addition, the hardware cost is low and, if it is properly maintained, it can produce clean copy in lieu of typesetting. However, it lacks several features offered by other more sophisticated equipment, a deficiency which seriously limits its effectiveness. In particular, the editing function requires extensive rekeystroking which is eliminated in other equipment by the use of a modifiable, magnetic storage medium. Of equal importance in a large-volume publishing system is the composition limitations imposed by the monospaced type. Monospaced type derives its name from the equal horizontal spacing assigned to each character. This equal spacing requires more space to accommodate the same amount of text because each character is assigned a space equal to that required by the widest character. This typically results in 20 to 25 percent less text per page or, conversely, requires 20 to 25 percent more pages for the same amount of text. In addition, the range of style and sizes of typefaces is very limited with the monospaced typewriter.

MAGNETIC CARD EQUIPPED WORD PROCESSOR. This is very similar to the monospaced typewriter with the exception that it is equipped with a modifiable storage medium which permits the operator to capture keystrokes on a mag-card during the encoding process. This permits unchanged text to be read from the mag cards during the editing process, thus eliminating the necessity of rekeystroking unchanged text. This has been shown to reduce the labor required in editing up to 50 percent. Figure C-2 depicts the information flow in a magnetic card based system. The hardware costs are greater than those for the monospaced typewriter but still moderate ($310 per month rental including maintenance). The other characteristics of the magnetic card equipped word processor are identical to those of the monospaced typewriter.

VDT WORD PROCESSOR. The Video Display Terminal (VDT) equipped Word Processor is similar to the magnetic card equipped word processor, but is equipped with a cathode ray tube video display which provides a window into the memory. This allows the operator to see what is stored on the modifiable magnetic medium without having to wait for it to be printed out as is required with less sophisticated machines. As a rule, the modifiable medium used for storage is a floppy disc, instead of a magnetic card, which results in further labor savings because a floppy disc will accommmodate approximately 100 pages of text as opposed to the single page stored on a magnetic card.

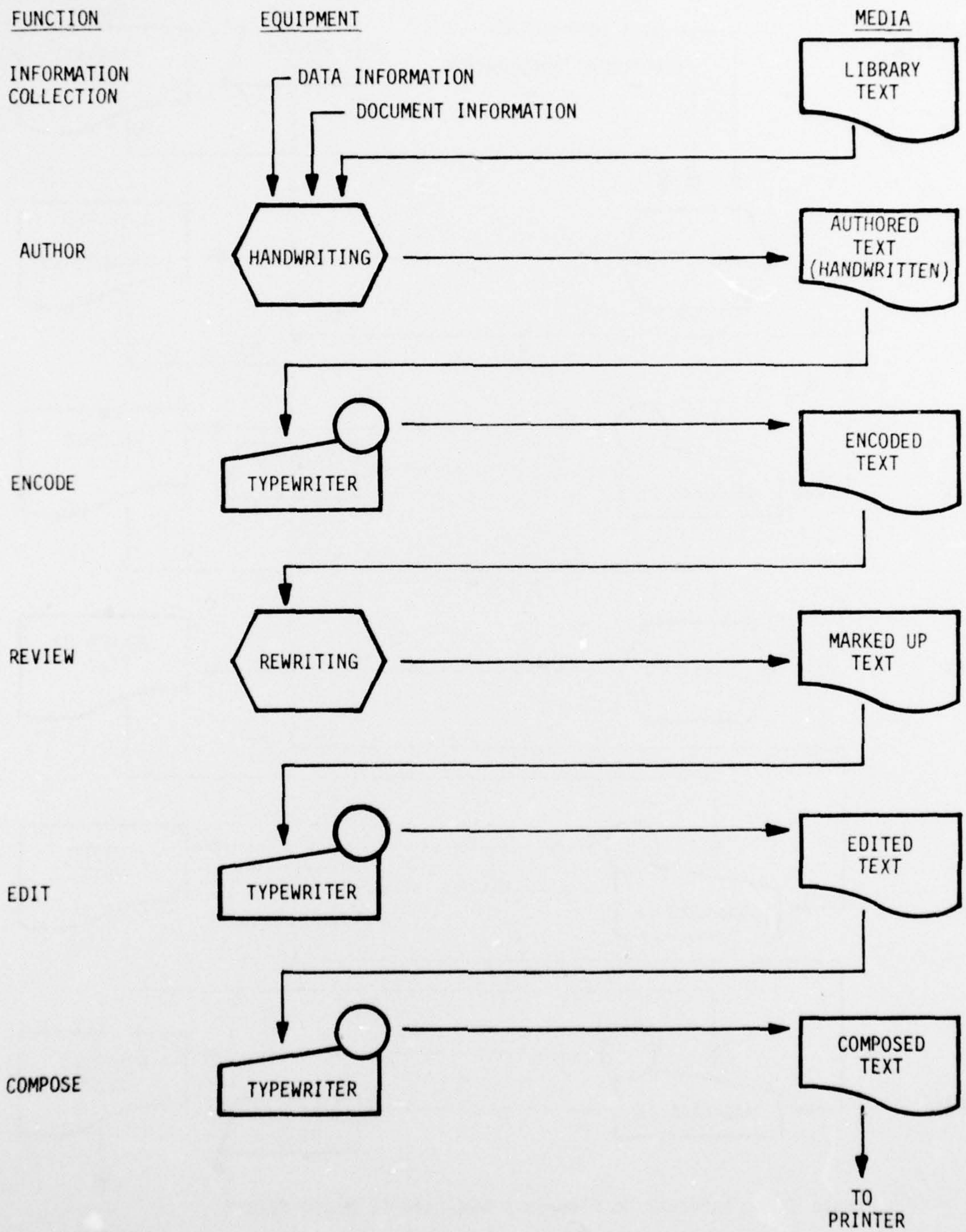

Figure C-1. Information Flow in a Typewriter Based System

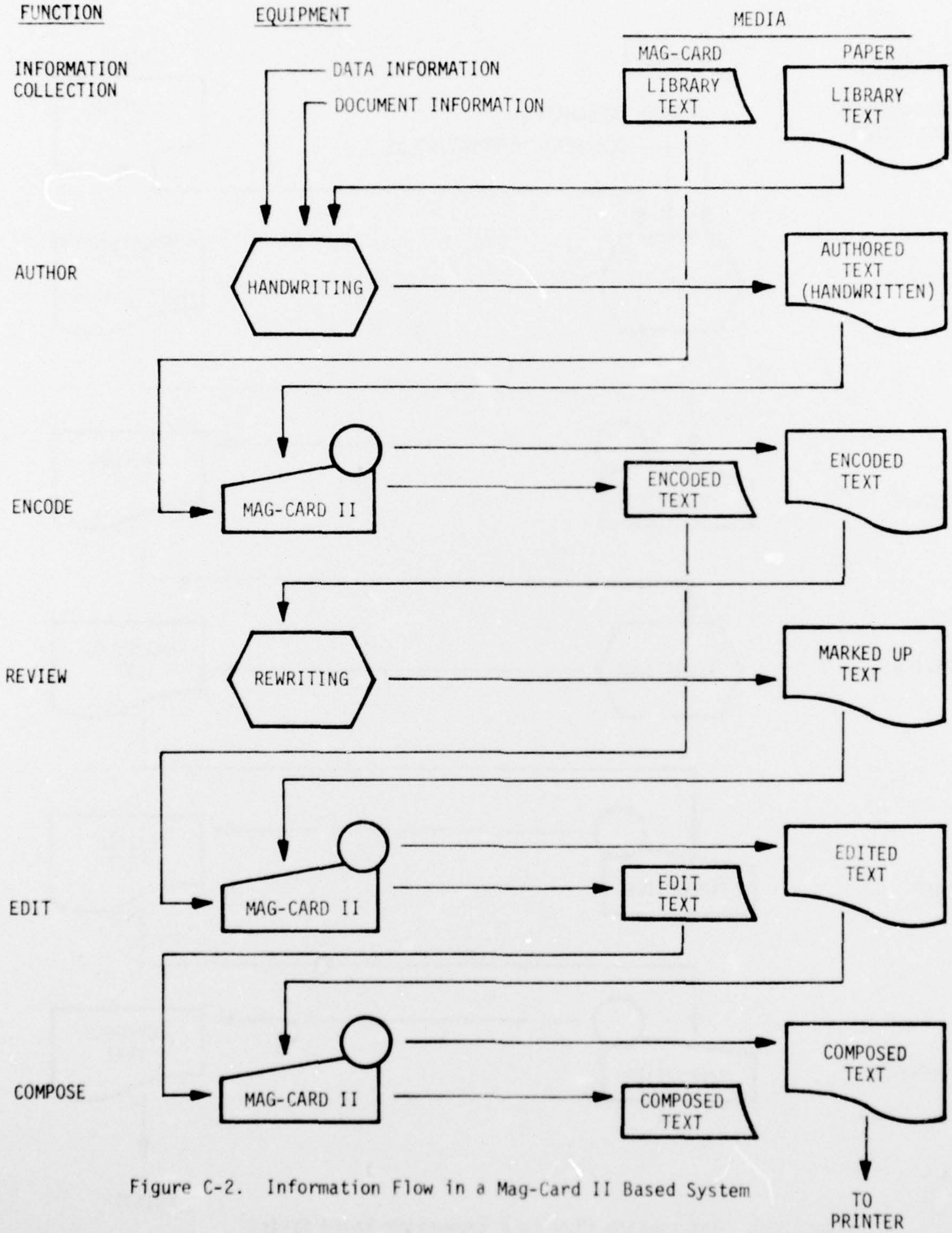

Figure C-2. Information Flow in a Mag-Card II Based System

The VDT machines are usually equipped with automatic search, replace and move capabilities so that a particular string of text may be manipulated anywhere within a page, greatly facilitating the editing process. The labor saving features offered by the VDT word processor reportedly result in twice the overall output of the magnetic card equipped word processor and up to six times the output of a standard typewriter. Figure C-3 depicts the information flow in a VDT word processor based system. The hardware costs of the VDT word processor are significantly higher than that of the magnetic card equipped word processor ($610 per month including maintenance). The remaining characteristics of the VDT word processor are the same as those of the monospaced typewriter and the mag-card II word processor.

TEXT EDITOR SYSTEM. The text editor system is a multiterminal device, similar to the VDT word processor Its primary usefulness also lies in the encoding and editing functions. It differs from the other encoding/editing devices discussed in that the terminals are not stand-alone devices. The text editor system has a central processing unit (CPU), which acts as a controller for all of the terminals, input/output tape devices, a printer, and an on-line memory device. Figure C-4 depicts a typical text editor system hardware configuration and the typical information flow in a text editor system. Because of each terminal's ability to share the same CPU without interfering with each other, a result of the inherently high speed of electronic computers, more powerful editing features may be built into the text editor system than could be cost justified in stand-alone devices. Two such features are global search and replacement of text strings in multipage documents and moving text from any place in a file to any other file in memory. An important distinction between word processors and text editor systems lies in their approach to document maintenance. The word processor maintains the document in pages. The text editor system maintains the document as a continuous stream of text. In the general office environment, this makes little difference because the usual document is generally a one or two page letter. However, in the publishing environment the typical working document is the size of a chapter, and it is more convenient to be able to use editing features which operate on the whole document. Thus, if a paragraph is added, it will not be necessary to reformat all subsequent pages, or if a stream of text is to be replaced, to "search" a page at a time. Of course the text editor system should (and does) have an automatic means for breaking the continuous text stream up appropriately into pages whenever a hard copy is produced by the printer for review. The hardware cost of a text editor system is dependent upon the number of terminals. A text editor system would cost about $77,000 with four terminals, or about $92,000 with nine terminals. (A text editor system can support up to 32 terminals with a single CPU.)

An important feature of the text editor system which has not been yet discussed is that the CPU is in reality a general purpose mini-computer. Because of this, it is flexible, thus new user defined functions may easily be incorporated by a change to the software. One user defined function which would be particularly useful in the publishing of CNET materials would be an automatic dictionary look-up of all words as a check for spelling. Another useful function would be an automated measure of the readability index, thus helping to assure that the published material is written at an appropriate reading level for the reader. The two special functions suggested could

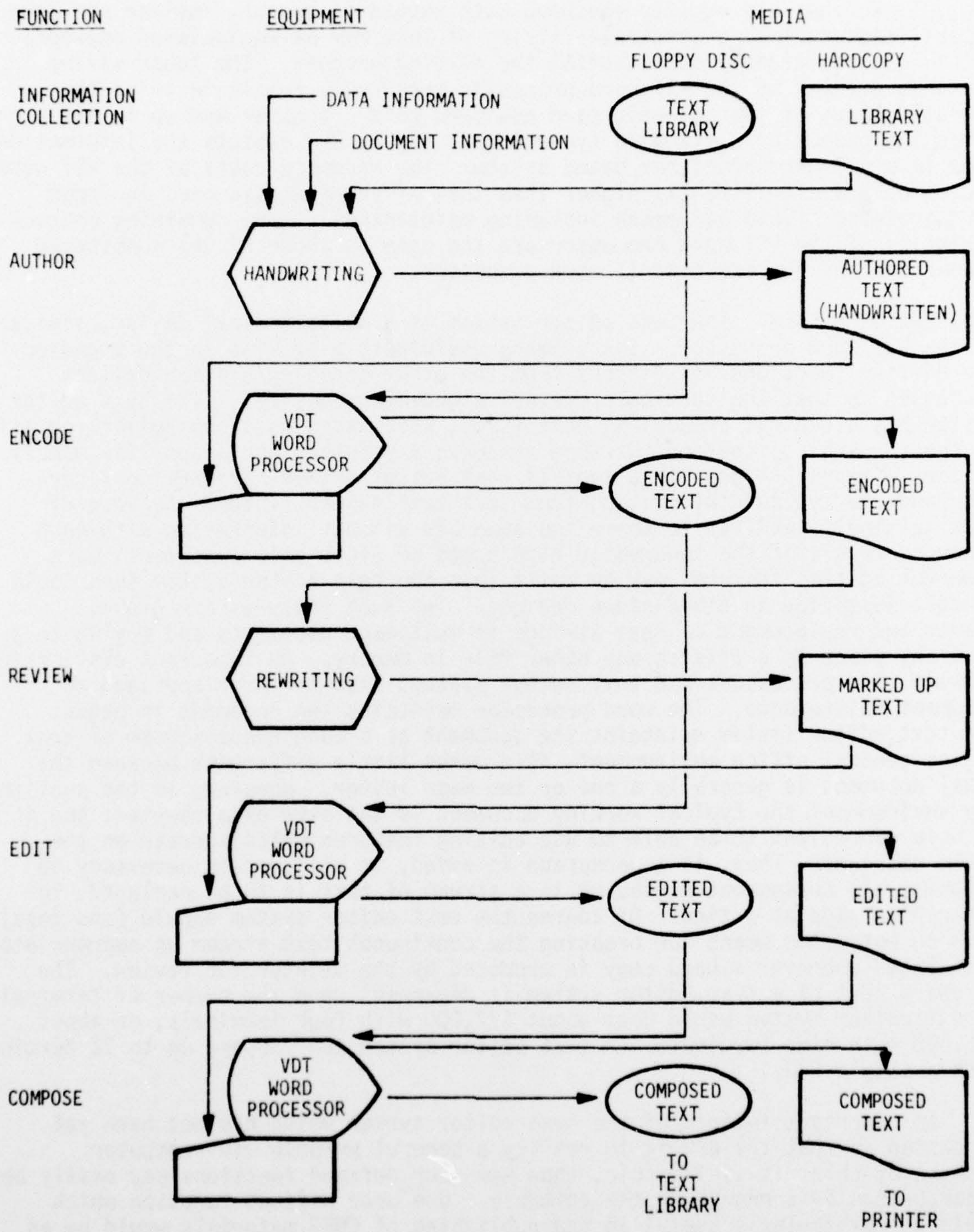

Figure C-3. Information Flow in a VDT Word Processor Based System

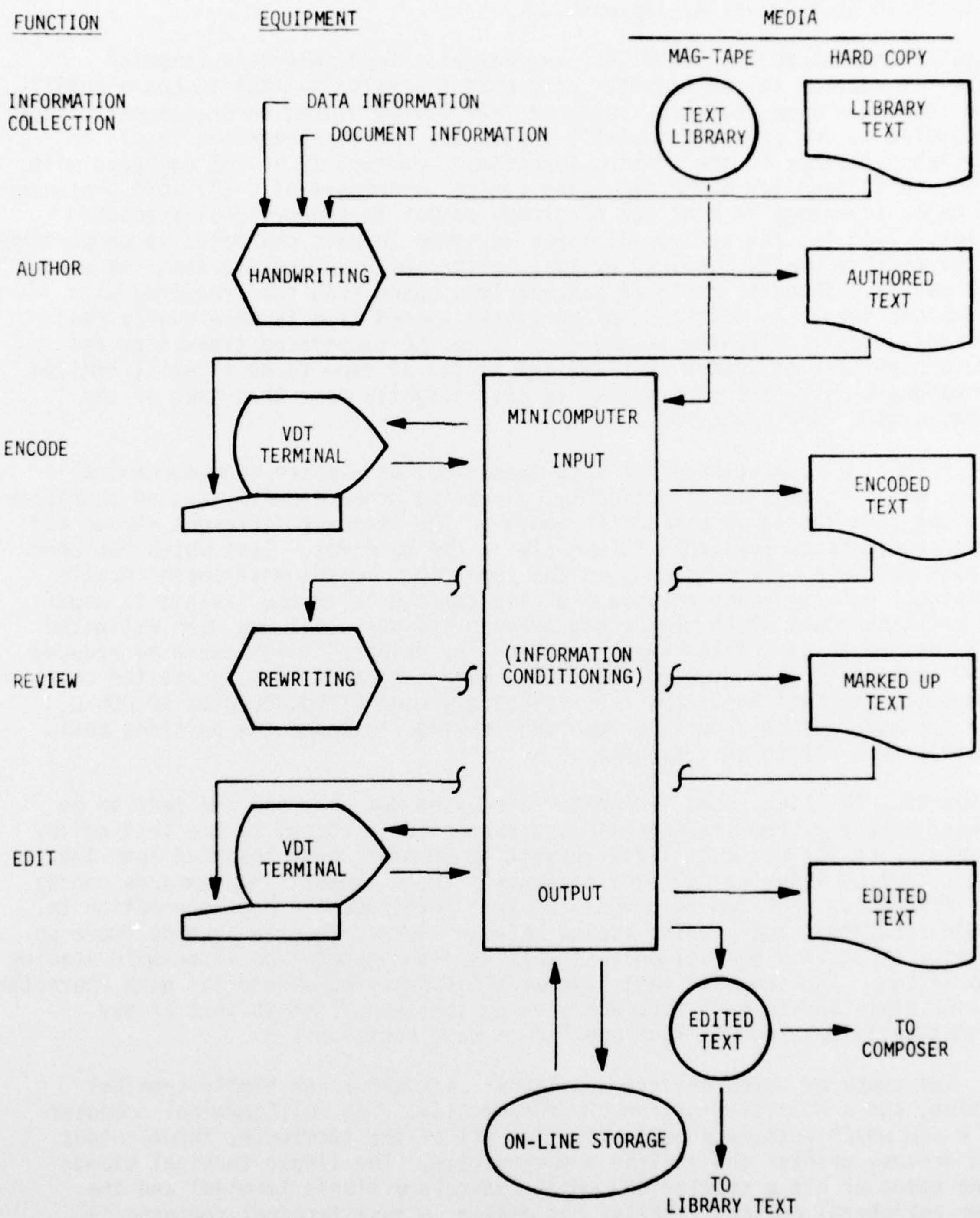

Figure C-4. Information Flow in a Text Editor Based System

easily be incorporated by a software change, and there are other functions which could also be easily implemented.

MAGNETIC TAPE SELECTRIC COMPOSER. The Magnetic Tape Selectric Composer (MTSC) is similar to the magnetic card word processor in that it has a modifiable storage medium, but many pages of text may be stored on one magnetic tape as opposed to one page per magnetic card. Its use may therefore result in some labor savings in the editing function. However, it is not equipped with a VDT, so it does not offer the labor saving advantages of a VDT word processor. Its major advantage is that its hard copy output is proportional-spaced typing. That is, the horizontal space assigned to each character is proportional to the width actually required by that letter, with the result that the same text may be printed in 20 to 25 percent less space than that required with monospaced type. In addition, proportional spaced type is more easily read and aesthetically pleasing to the eye. Like the monospaced typewriter and word processors, the range of sizes and styles of type faces is still limited. The hardware cost ($380 per month) is only slightly more than that of the magnetic card word processor.

TYPESETTER. A typesetter is an opto-mechanical or electro-opto-mechanical device which is capable of optically generating proportionally spaced characters from the text stored on a magnetic medium. The range of different styles and sizes of typefaces available is usually in the hundreds. Text which has been typeset can be easily read and, at the same time, be the most aesthetically pleasing. But the major advantage of typesetting is in the savings in paper and printing costs which may be had through its use. (It has been estimated that the number of printed pages required for printing a PQS could be reduced by 50 percent through typesetting.) The hardware costs of a typesetter capable of meeting the CNET requirement is relatively high ($100,000 plus $8,000 a year for maintenance), but the resultant savings in paper and printing costs can more than offset this expense.

COMPOSERS. The high speed typesetter discussed may not read the text to be typeset directly from the magnetic storage medium produced by the text editor or word processor but must have typesetting command codes inserted into the text stream by a device called a composer. These typesetting commands convey the information required to format the text into pages; e.g., information to change typefaces, add leading (space between lines), reverse leading (move up the page to start a new column), as well as inter-letter and inter-word spacing information. The composer must have width information stored for each character of each style and size of typeface used by the typesetter so that it may automatically make end-of-line and end-of-page decisions.

Two types of composers are available: a stand-alone single-terminal version, and a multiterminal or cluster version. The multiterminal composer has a CPU which acts as a controller for all of the terminals, input/output tape drives, printer and on-line memory device. The single-terminal stand-alone composer has a smaller CPU which controls a single terminal and the other peripheral devices. Dollar for dollar, a multiterminal composer is usually more powerful than a stand-alone single-terminal composer. But this is applicable only if the work load is sufficient to require the operation of

several terminals. On the other hand, some of the manufacturers of the stand-alone composers have attempted to capture the market of stand-alone word processor users by designing their stand-alone composers to accept word processor floppy discs or mag tapes as input text. Such a stand-alone single-terminal composer costs about $60,000. By way of comparison, a multiterminal composer would cost about $125,000 with two terminals, or about $195,000 with 12 terminals. (A multiterminal composer is limited to about 12 terminals per CPU in order to avoid processing delays.)

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